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UNIVERSITY OF ALBERTA

SKIN CANCER PREVENTION: PERSONALIZED ADVICE AND COMPLIANCE

BY

JAMES CHOU

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF HEALTH SERVICES ADMINISTRATION

IN

DEPARTMENT OF HEALTH SERVICES ADMINISTRATION
AND COMMUNITY MEDICINE

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Dr. Gordon Flowerdew

Dr. Sharon Campbell

Date: March 15th, 1994

DEDICATION

This work is dedicated to my family and Bruni Baumgardt.

ABSTRACT

Growing concerns with the rapid increase in the incidence of non-melanomatous and melanomatous skin cancers over the last few decades have resulted in a greater emphasis being placed on skin cancer prevention.

The study utilized self-reported data from the Alberta Cancer Board (ACB) project "Cancer Prevention in the Workplace" to examine the influence of personalized skin cancer prevention advice on sun protection behaviours among adult workers, and attempted to determine whether knowledge, attitudes, and beliefs differed between individuals who were frequent and infrequent in their practice of sun protection behaviours. Eight hundred and eighty-five subjects, ages 21 to 63 years of age, from two large corporations in the City of Calgary were assigned to one of three treatment groups. A control group received no intervention while those in the three treatment conditions received personalized skin cancer prevention advice either by letter, computer, or computer and letter. The effectiveness of the study intervention in engendering positive change in behaviour was determined by examining overt changes, over twelve months, in sun protection behaviours: 1) sunscreen use, 2) wearing a hat, 3) wearing protective clothing, and 4) avoiding the sun between 10 a.m. and 3 p.m. The Transtheoretical Model of stages of behaviour change (Prochaska and DiClemente, 1992) was used to investigate patterns of both overt and covert behaviour change over time.

Seven hundred and thirty-three subjects (385 males, 348 females) completed all questionnaires and they constituted the sample for the study. Chi

square tests revealed an increase in the practice of sun protection behaviours over the twelve-month period. Among males, noticeable increases were found in sunscreen use (14.5%), wearing a hat (13.8%), and wearing of protective clothing (18.0%). Among females, noticeable increases were found in sunscreen use (22.1%), wearing protective clothing (16.6%), and avoiding the sun (17.4%). These findings were supported by results indicating a greater proportion of subjects from the intervention group moving forward in the stages of change, compared to those in the control group. Individuals who frequently practised sun protection behaviours were found to be less fatalistic about their ability to prevent skin cancer and less fatalistic about their ability to control it should it occur in their lives. No other consistent correlations were found between the frequency of practising sun protection behaviours and knowledge, anxiety, denial, and beliefs.

It is concluded that personalized advice appears to be effective in encouraging individuals in worksites to increase their practice, or intention to practice, sun protection behaviours. Generalization of this result is, however, restricted to individuals with backgrounds similar to those of the subjects of the study.

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CHAPTER ONE

STATEMENT OF THE PROBLEM

Introduction

This chapter provides background information regarding suntanning and the scope of the problem of skin cancer. The objectives of the study, its significance, and the study's research questions are outlined. In addition, limitations of the study are discussed and key terms utilized in the study are defined.

Background Regarding Suntanning

A belief in the health-giving and healing powers of sunlight dates back thousands of years (Giese, 1976). Vedic writings attest to the sun-worshipping ceremonies of the Aryans of India of the Vedic Period (1500 B.C. to 500 B.C.). The sun held great significance for the ancient Assyrians, Greeks, Persians, Zoroastrians, Egyptians, and Phoenicians. They revered the sun as a deity or the god of health who had the power to endow human beings with life- and health-giving rays (Giese, 1976).

According to Keesling and Friedman (1987), the popularity of sunbathing in North America has been influenced by three historical events. In the 1800s, the image of a suntan was associated with one's social status. Possession of white skin colour meant that one was not engaged in menial manual labour. With the advent

of the Industrial Revolution, however, the working class moved from an outdoor to an indoor working environment. This led to a shift in social status symbols and a dark skin colour became a sign of higher status, since it was associated with one having a preponderance of time to engage in leisure activities and sports. Then in the early 1900s the work of Auguste Rollier, who was the first to note that tuberculosis patients improved following sun exposure, sparked the heliotherapy craze in North America. Vitamin D, which is produced when skin is exposed to sunlight and changes colour, inhibits the growth of the tubercle bacillus. Despite the fact that, initially, the synthesis of vitamin D was not acknowledged to be the causal factor in the success of the therapy, having a dark tan came generally to be associated with good health. Thereafter, the popularity of suntanning could be traced to French designer Coco Chanel, who was reported to have started the fad of tanning. In the 1930s, suntanning in North America reached a peak in its popularity as part of the heliotherapy and nudity craze (Keesling & Friedman, 1987). Today, suntanning is still popular and the value of possessing a tan is still upheld by many. However, because of increased public awareness, progressively more individuals are acknowledging or realizing that the practice of suntanning is harmful to their health and, when carried to extremes, can lead to skin cancer.

Skin Cancer and Exposure to Sunlight

The incidence of melanomatous and non-melanomatous skin cancers has been increasing rapidly worldwide over the last three decades, particularly between 1965

and 1985. In certain areas, dramatic increases of over 100% have been reported (Green, 1982). In Queensland, Australia, for example, the incidence of melanoma in 1965 was 16.4 per 100,000 inhabitants per year. By 1980, the incidence had risen to 39.6 per 100,000 inhabitants per year (Green, 1982). In 1984, this region was reported to have had the highest incidence of non-melanomatous skin cancer in the world (Stenbeck et al., 1990). Skin cancer is the most frequently occurring cancer in Australia (Cockburn, Hennrikus, Scott & Sanson-Fisher, 1989). In New Zealand and the United Kingdom, the incidence of melanoma has doubled over the last ten years (Glasgow, 1988). A rapid increase in melanoma has been reported in Scotland from 1979 to 1989. Over this eleven-year period, an overall increase of 82% (7.4% per year) was observed (MacKie et al., 1992). In Denmark, the age standardized incidence of cutaneous malignant melanoma increased five- to six-fold between 1943 and 1982 (Osterlind, 1990). Nordic countries also have reported a rapid increase in melanoma (Jenks, 1992).

In North America, similar trends have been reported. In the United States, non-melanomatous and melanomatous skin cancers account for 30% - 40% of all cancer diagnosed annually. These most common forms of cancer in the United States continue to increase (Epstein, 1983). It is estimated that a 3% to 5% increase in new cases of skin cancer per year can be expected. One in seven Americans is expected to develop skin cancer during his/her lifetime (Kelly, 1991). Furthermore, many dermatologists anticipate that skin cancer will occur at a younger age (Edwards & Edwards, 1982). In Canada, between 1969 and 1988, the age-standardized

incidence of melanoma increased about 6.2% per year in men and 4.8% per year in women. Between 1950 and 1989, the age-standardized mortality rates of melanoma increased by 3.4% per year in men and 2% in women. The incidence rates have continued to rise rapidly. The mortality rates, however, have shown some stability from about 1985 onwards (Elwood, 1992b). Based on Canadian Cancer Statistics, the estimated number of newly diagnosed cases of, and deaths from, melanoma in Canada during 1990 were 2,600 and 520 respectively. Melanoma claimed 10,000 person years of life in 1987 (Miller, 1992). The 1990 Alberta Cancer Registry reported melanoma to be the most rapidly increasing type of tumour in Alberta, accounting for 2.9% of all tumours diagnosed. The age-standardized incidence rate was 8.1/100,000 in males and 10.7/100,000 in females. A relatively low case-fatality rate was reported (8.4%). Similarly, nonmelanoma was reported as the most frequently diagnosed malignant tumour in Alberta despite the potential for under-reporting. The age-standardized incidence rate was 131.7/100,000 in males and 94.8/100,000 in females. Although the mortality rate from non-melanomatous skin cancer is extremely low (0.3% case-fatality rate in 1990), skin cancer in general is a serious problem and warrants attention through prevention and control.

Objectives of the Study

The objectives of this study were:

1) to investigate whether or not personalized advice will facilitate change in sun protection behaviours by observing overt improvements in sun protection

behaviours over time, and by examining both overt and covert improvements in sun protection behaviours with the use of a model of stages of behaviour change, and

2) to investigate whether or not knowledge, attitudes, and beliefs differ between individuals who frequently and infrequently practice sun protection measures.

Research Questions

1) Are sun protection behaviours likely to change over time with provision of personalized advice?

2) Do individuals who frequently practice each of the sun protection measures differ in knowledge, attitudes, and beliefs from individuals who infrequently practice these measures?

3) What proportion of subjects in the intervention and control groups progressed from one stage of change to another with the provision of personalized advice?

   This question investigated whether or not subjects' practice of, or intentions to practice, sun protection measures progressed over time, by examining movement between the stages of behaviour change as defined by the Transtheoretical Model.

Significance of the Study

Greatly increased rates of skin cancer on a global scale have raised concern

in the health care community. Efforts to protect against the harmful effects of ultraviolet radiation through prevention have been recognized as being of great importance for primary prevention. As skin cancer has come to be known as a classic lifestyle disease of the twentieth century, behavioural research in cancer prevention and control has increased in recent years in response to the need (Shiffman et al., 1991).

The present study is a further attempt to examine the effectiveness of minimal intervention in skin cancer prevention. The findings from this study could potentially provide insights on behaviour change processes as they apply to sun exposure practices. These insights could assist in planning more effective skin cancer prevention programs. In addition, this study may extend knowledge related to the application of the stages of behaviour change model (Transtheoretical Model) to another relatively unexplored health behaviour.

Furthermore, the growing economic constraints experienced by Canada over at least the last decade have prompted provincial government initiatives to curtail health care spending, which constitutes 30% of the government's budget (Philippon, 1992). In the province of Alberta, the challenge to curtail spending has brought about a paradigm shift in health care approaches for maintaining or attaining better health among Canadians. Among these changes is a greater emphasis on health promotion and disease prevention, which is regarded as an economically more viable approach to meeting desired health care objectives (Philippon, 1992).

Limitations of the Study

a) One potential shortcoming of this self-reported study is the variability in subjects' interpretation of what constitutes the practice of a sun protection behaviour. A subject who routinely sunbathes for a few hours before applying sunscreen may respond in the questionnaire as if always using sunscreen when exposed to the sun for an extended period. This response may be theoretically correct but misleading in the context of sun protection behaviour.

b) It is acknowledged that recall bias could have influenced subjects' ability to respond accurately to questions, since subjects were required to recall their behaviours over a one-year period. One initiative taken to address this potential bias was the revision of the four-point scale on all the sun protection behaviours. Collapsing the four-point scale to a two-point scale broadened the categories of the scale. Thus, a subject who was uncertain whether or not he/she had always or usually used sunscreen over the last year but checked off either one of the two options would still be appropriately classified as frequently practicing a particular behaviour. Revision of the sun protection behaviours scale is further addressed in the section "Data Analysis Techniques" (Chapter III, p. 49).

c) The operational definition of the "maintenance" stage adopted by the present study requires subjects to be practicing sunscreen use, wearing a hat, and wearing protective clothing for more than twelve months. Since the follow-up period of the study was one year, subjects in the precontemplation or

contemplation stages did not have adequate time to show progression to the maintenance stage. This definition, in essence, limits the study's ability to show higher progression in the stages of change for subjects in the precontemplation and contemplation stages.

d) The corporations/worksites for the study were not randomly selected due to logistical constraints. This provides limited external validity to the findings of the study. As a result, generalization of the study findings is limited to population(s) that are identical to these corporations.

Terminology

"Personalized advice" refers to individualized feedback provided to a subject regarding general risk that he/she has for skin cancer (based on self-reports of lifestyle and personal health history) and regarding the appropriate preventive measures to adopt. An example of such personalized advice would be, "You have a tendency to burn easily when exposed to the sun for prolonged periods; people with this predisposition have a higher risk of getting skin cancer." The preventive measures recommended to subjects in this study include: reduction of sun exposure between 10 a.m and 3 p.m., application of sunscreen which has a minimum rating of sun protection factor (SPF) 15, wearing protective clothing (long sleeves and pants), and wearing a hat.

"Sun protection behaviours" refer to preventive actions that an individual has adopted against overexposure to ultraviolet radiation. In this study, the term covered four

behaviours: sunscreen use with SPF 15 or more, avoiding the sun between 10 a.m. and 3 p.m., wearing a hat, and covering arms and legs with clothing when spending time in the sun.

"Knowledge" refers to an understanding of what causes skin cancer, of cure rates for skin cancer, and of behaviours that prevent skin cancer.

"Belief" refers to personal conviction or persuasion that a certain thing is real and true.

"Attitudes" refer to "a relatively enduring organization of beliefs around an object or situation predisposing one to respond in some preferential manner" (Rokeach & Smith, 1968).

"Edema" refers to an accumulation of an excessive amount of watery fluid in cells, tissues, or serous cavities.

"Erythema" is an inflammatory redness of the skin.

"Hyperpigmentation" refers to an excess of pigment in a tissue or part.

"Hypopigmentation" refers to a shortage of pigment in a tissue or part.

"Telangiectasis" refers to a dilation of the previously existing small or terminal vessels of a part.

"Actinic Keratoses" refers to a lesion on the epidermis marked by the presence of circumscribed overgrowth of the horny layer as a result of exposure to chemically active rays of the electromagnetic spectrum.

"Cutis Rhomboidalis Nuchae" refers to the geometric configurations of the skin of the back of the neck as a result of aging or prolonged exposure to sunlight.

"Systemic Malignancies" refer to a general worsening medical condition, specifically somatic in nature, which may lead to an ingravescent course.

Stages of Behaviour Change

The stages of behaviour change algorithm, as defined by Prochaska and DiClemente (1992), is outlined below. In addition, the operational definitions as applied to the present study are provided.

1) Individuals in the precontemplation stage are unaware or unwilling to change their risk behaviours. They are not convinced that the consequences of the problem behaviour outweigh benefits. They may also believe that the problem behaviour is well controlled and under self-regulation.

2) Individuals in the contemplation stage are actively involved in considering the prospects of change. They tend to engage in information seeking, to reevaluate themselves in light of their problem behaviour, and to evaluate the pros and cons that change would bring. Contemplators are, however, not ready to take action.

3) The preparation stage indicates a readiness to change both attitude and behaviour. These individuals are on the verge of taking action and need to set goals, priorities, and commitments to adhere to the actions they choose.

4) The action stage involves the overt modification of the problem behaviour. Individuals engage in effective behaviour modification strategies to alter their behaviour and to prevent any relapses back to earlier stages.

5) In Maintenance, the final stage of change, individuals have been successful in altering their problem behaviour for over six months.

Operational definitions of the stages of behaviour change in the context of the present study:

"Precontemplation stage" - no serious consideratio ı to increase protection from the sun.

"Contemplation stage" - the intention to increase sun protection in six months' time.

"Preparation stage" - the intention to increase sun protection immediately or in the next 30 days.

"Action stage" - the adoption of sun protection practices within the past twelve months.

"Maintenance stage" - the adoption of sun protection practices for over a year. Figure 2 (Chapter III, p. 41) shows how the staging algorithm is operationalized in this study .

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

Literature on ultraviolet radiation, solar induced skin damage, benefits of sun exposure, education and behaviour change, and the Transtheoretical Model of behaviour change are presented in this chapter.

Ultraviolet Radiation

The earth is constantly bombarded with solar radiation. As a result, electromagnetic energy is continually being transferred from the sun to the earth through radiative processes. Electromagnetic energy can be considered as a spectrum defined by both a wavelength and an energy level. The electromagnetic spectrum in turn can be divided into ultraviolet, visible and infrared segments. The rays of the visible spectrum range from 400 nanometre (nm) to 780 nm in length. These colours of the spectrum are violet, blue, green, yellow, orange, and red. Wavelengths between 780 nm and 1,020 nm constitute the infrared and radio spectra (Lonstreth, 1987).

Ultraviolet radiation (UVR) is classified into three categories: ultraviolet C (UV-C), ultraviolet B (UV-B), and ultraviolet A (UV-A). The wavelength of UV-C ranges from 100 nm to 295 nm. Although UV-C is efficient in causing erythema in

normal skin and can cause photokeratitis (Parrish, 1982), it is absorbed in the upper atmosphere and does not reach the earth (Longstreth, 1987). The wavelength of UV-B ranges from 295 nm to 320 nm and it primarily affects the epidermal layer of the skin. Unlike UV-C, small quantities of UV-B reach the earth. Like UV-C, it is very efficient in causing erythema (Parrish, 1982). UV-B also is known to be necessary for the synthesis of vitamin D3 (Holick, MacLaughlin, Parrish & Anderson, 1982). The wavelength of UV-A ranges from 320 nm to 400 nm. Due to its longer wavelength, UV-A penetrates deeper into the dermis than UV-B, and probably has more effect on the breakdown of collagen (Jarrat, Hill & Smiles, 1983; Mallory & Watts, 1987). Studies have shown that UV-A augments UV-B carcinogenesis (Matsui & DeLeo, 1991; Staberg, Wulf, Klemp, Paulsen & Brodthagen, 1983; Willis, Mentor & Whyte, 1981; Mallory & Watts, 1987). Large quantities of UV-A also have been shown to induce erythema, melanogenesis, and elastosis and other dermal connective tissue damage (Parrish & Jaenicke, 1982; Kumakiri, Hashimoto & Willis, 1977).

Ozone differentially absorbs various wavelengths of UV-B; it has little effect on UV-A and no effect on visible light. Among the three categories of UVR, the most adverse biological effects are induced by UV-B, particularly by wavelengths between 295 nm and 300 nm. The degree of biological effect sustained is influenced by the duration of exposures at particular locations, times of day, and times of year; by behaviour such as use of protective clothing and sunscreen; by pigmentation; and by the action spectrum of the target molecules. Cloudiness and albedo (reflection from surfaces) can cause large variations in UV-B and UV-A, but they affect all

wavelengths relatively equally. UV-B is, however, the most affected by latitude, variation in season, altitude and time of day. A large proportion of total daily radiation at 295 nm arrives between 11 a.m. and 1 p.m. (Longstreth, 1987). It has been shown that for every one-hundred-foot increase in altitude there is a 10% increase in the amount of UVR (Cramer, Gentry & Kaidbey, 1979). UVR also increases with closer proximity to the equator because of the increased number of daylight hours, and the more direct path of the sun's rays (Berger & Urbach, 1982). The depletion of the ozone layer will potentially result in a greater amount of UV-B reaching the earth's surface while little or no increase in UV-A will be noted (Longstreth, 1987).

Solar Induced Skin Damage

The deleterious biological and/or health effects of overexposure to sunlight have been known for many years. When unprotected skin is exposed to sunlight and sufficient radiation energy is absorbed by molecules in the skin, a photoallergic or phototoxic reaction occurs. Typically, the adverse effect is phototoxicity (Hawk & Parrish, 1982).

One acute reaction to overexposure to sunlight is sunburn. This is marked by vasodilation, increased vascular permeability with extravasation of fluid into tissues, and leukocyte migration to the site of damage. Clinically, sunburns are manifested by pain, edema, and erythema, which begin several hours after exposure and last for one to two days. In cases of severe damage, erythema may be followed by

desquamation or "peeling" and/or by hyperpigmentation (Mallory & Watts, 1987). Systemic effects such as fever, nausea, chills, vomiting, dehydration, and electrolyte imbalance may occur. The body's natural response to UVR irradiation is inflammation. A series of changes in microcirculation and in tissue occurs in an attempt to remove the injurious agent and to repair the damage. Following the inflammation, production of the pigment melanin is increased and the stratum corneum is thickened. The result is a tan. Although this initial process offers minimal protection, it spurs the production of melanin and cell division in the dermis. Approximately three weeks is required for new cells with melanin to reach the surface. Better protection is achieved with the thicker stratum corneum, which offers up to twenty times more protection against UVR. Better UVR protection is also achieved with increased melanin concentration. Melanin serves the role of absorbing and scattering UVR, and stabilizing free radicals resulting from photochemical responses to UVR (Hawk, 1982; Hawk & Parrish, 1982).

The responses described above are typical of UV-B induced tanning. UV-A induced tanning, however, offers less protection against UVR. UV-A tanning is not associated with significant changes in epidermal structure, including increased thickening of the stratum corneum (Gange, Blackett, Matzinger, Sutherland & Kochevar, 1985). Furthermore, the pigment melanin is predominantly located in the basal layer rather than distributed throughout the epidermis. This provides minimal protection against sunburn. Significant photoprotection against erythema can be obtained, however, if a sufficiently intense tan is induced by UV-A (Roser-Maass,

Holzle & Plewig, 1982).

The potential for developing sunburn is dependent on the length of exposure, pigmentation, direction of the sun's rays, time of the day during exposure, geographical location, altitude, and age. For example, individuals exposed to the sun between 11 a.m. and 2 p.m. will develop a sunburn more quickly than when exposed during other hours because the greatest amount of UV-B reaches the earth's surface between these hours (Longstreth, 1987). Infants and children are more susceptible to sunburn than young adults, because of the thinness of the outer epidermis of their skin (Mallory & Watts, 1987). Individuals with fair complexions usually have lesser amounts of melanin, which shields against UVR. Hence, they are more at risk for the various adverse biological effects caused by UVR (Vermeer et al., 1991).

The inflammation, repair, and protective processes of the body typically operate for a short time and then cease to act. Since neither the repair nor the protective processes are perfect, continuing exposure will result in chronic effects such as wrinkling, hyperpigmentation, hypopigmentation, telangiectasis, atrophy, actinic keratoses, cutis rhomboidalis nuchae, skin cancer, cataract and retinal degeneration, and possible impaired immunological responses that increase risks of other conditions, including systemic malignancies (Kligman, 1969; Mallory & Watts, 1987; Johnson & Lookingbill, 1984; Olson, 1989; Jones, 1987; Last & Guidotti, 1991; Prawer, 1991). Of particular interest to this study is the effect of skin cancer caused by UVR.

The literature on skin cancer has implicated cumulative, intermittent, intense

or recreational sun exposure on humans as a major cause of skin cancer (Friedman, Rigel & Kopf, 1985; Lawler & Schreiber, 1989; Vitasa et al., 1990). Cumulative exposure to UV-B has been directly associated with the development of nonmelanomatous skin cancer (Stern, Weinstein & Baker, 1986; Fitzpatrick, 1986; Urbach, 1989). Epidemiologic studies have lent support to the observed relationship by showing that nonmelanomatous skin cancer occurs most frequently in skin areas that are exposed to the sun. The head, neck, arms, and hands have been identified as common sites for nonmelanomatous skin cancer (Scotto, 1987; Gallagher et al., 1990; Green & Battistutta, 1990). Further support for the causal relationship between sun exposure and development of nonmelanomatous skin cancer is demonstrated by a greater incidence of skin cancer in those who spend more time working outdoors than in those who work indoors (Pathak, 1991). Studies also have shown that pigmented races, who sunburn less rapidly than white-skinned people, are less likely to develop nonmelanomatous skin cancer (Vermeer, Schmieder, Yoshikawa & van-den-Berg, 1991; Green & Battistutta, 1990; Urbach, 1991). Studies with mice have found repeated doses of UV radiation to produce skin cancer (Wick, Husain & Pathak, 1990; Pathak, 1991).

The link between UV-B and the development of cutaneous malignant melanoma (CMM), however, is less defined, with reviews ascribing different degrees of certainty to the relationship. Analytical epidemiological research has not conclusively shown that melanoma is ultraviolet dependent (Cascinelli & Marchesini, 1989). The absence of an experimental animal model of epidemiologic studies of

CMM, where individual human UV-B exposures have been adequately assessed, and of an in vitro model for malignant transformation of melanocytes, has prevented unambiguous demonstration that ultraviolet radiation (UVR) or UV-B causes melanoma (Longstreth, 1987). Nevertheless, UV-B has been identified as one of the contributing factors in the development of CMM (Augustsson, Stierner, Rosdahl & Suurkula, 1991; Sober, Lew, Koh & Barnhill, 1991; Green, 1985). Studies have demonstrated that the risk of malignant melanoma is related to intense intermittent sun exposure versus chronic sun exposure (Elwood, 1992a; Gallagher, Elwood & Yang, 1989; Elwood, Gallagher, Hill & Pearson, 1985). Excessive sun exposure and sunburns in childhood have been implicated as a major risk for developing malignant melanoma. Studies have indicated that excessive exposure to the sun during the first ten to twenty years of life significantly increases the risk of skin cancer (Titus et al., 1991; Boldeman, Jansson & Holm, 1991; Lee, 1989; Truhan, 1991). This risk of developing skin cancer, however, can be decreased by adopting preventive measures. Unfortunately, compliance with recommendations regarding sun exposure is difficult to achieve.

Recent controversy over the role of ozone depletion in the development of skin cancer has sparked tremendous interest both in the political and industrial arenas. Some scientists have purported that continuous atmospheric changes, such as the depletion of the ozone layer, are potentially heightening the incidence and mortality rates of skin cancer (Moan & Dahlback, 1992; Kelfkens, de-Gruiji & vander-Leun, 1990; Henriksen, Dahlback, Larsen & Moan, 1990). Others have

estimated that a 1% reduction in the ozone shield would result in a 2% increase in UV-B, which is the ultraviolet radiation that is most responsible for skin cancer reaching the earth's surface (MacKie & Rycroft, 1988). It should, however, be noted that the thinning of ozone layer has not been conclusively verified, although "holes" in the ozone layer have been reported in Antarctica (Rowland, 1990; Pyle, Carver, Grenfell, Kettleborough & Lary, 1992). Furthermore, it has not been definitively shown that stratospheric ozone depletion is translated into an increase in ultraviolet radiation reaching the earth's surface (Coldiron, 1992). To date, the evidence for the phenomenon of ozone depletion and its potential effects on increasing the incidence and mortality rates of skin cancer remains weak.

Benefits of Sun Exposure

Exposure to the sun is not without benefits (Kime, 1980). The skin has been recognized as the site for the sun-mediated photosynthesis of vitamin D. During exposure to sunlight, vitamin D3 (cholecalciferol), which is the most active metabolite of vitamin D, is produced photochemically in the skin from the provitamin, 7-dehydrocholesterol (Holick, 1981; Holick et al., 1982; Davies, 1989). Studies published over the last twenty years appear to concur with findings from earlier studies supporting the benefits of sun exposure (Ainsleigh, 1993). These studies have suggested an inverse relationship between the levels of photochemically produced vitamin D and the development of breast cancer, colon cancer and leukemia.

Gorham, Garland, and Garland (1989) provided the first epidemiological work

revealing the relationship between sun exposure and breast cancer. They reported that breast cancer mortality rates in ten Canadian cities were elevated with increased levels of acid haze, which screens ultraviolet rays and reduces vitamin D synthesis. Garland, Garland, Gorham, and Young (1990) also found that the incidence rate of breast cancer in the United States varied across geographical areas. They found a strong negative correlation between availability of sunlight and breast cancer rates. Areas with lesser available sunlight were reported to have higher mortality rates for breast cancer. Geographical variations in colon cancer rates relative to availability of sunlight also have been reported. An inverse relationship between greater availability of sunlight and the incidence of colon cancer was established by the Garland and Garland study (1980).

Caution has to be exercised, however, in drawing a causal relationship between exposure to sunlight and reduced incidence rates of various types of cancer. The experimental methodology utilized in these studies is ecological in nature. Such a methodology has its strengths in generating hypotheses and not in establishing cause and effect relationships.

An eight year prospective study investigating the relationship of serum 25-hydroxyvitamin D and colon cancer also provided indirect support for the role of sun activated vitamin D in reducing the risk of colon cancer (Garland et al., 1989). This study demonstrated that lower colon cancer incidence rates were associated with increased blood levels of serum 25-hydroxyvitamin D, a necessary precursor to vitamin D3. The protective effect of sunlight-synthesized vitamin D on differentiating

myeloid leukemia cells and returning these cells to normal has been demonstrated in a number of studies (Mangelsdorf & Koeffler, 1984).

Other benefits of photochemically synthesized vitamin D include the absence of potential overdose toxicity, present in oral vitamin D supplements. Moreover, the photosynthesis of vitamin D bypasses any gastrointestinal vitamin D malabsorption problem associated with diet (Webb & Holick, 1988). In addition, it is less costly and generally has a high patient acceptance/compliance rate.

Based on the benefits of sun exposure as indicated by these studies, and other purported benefits that are less well established, some health professionals have encouraged the practice of regular sun exposure as a preventive measure against the more common forms of cancer (Ainsleigh, 1993).

The recommendation by Ainsleigh (1993) to expose oneself regularly to the sun, even during the noon hour for short periods, appears to be a drastic measure, especially in light of the rising incidence and mortality rates of skin cancer. While sunlight-synthesized vitamin D may have been demonstrated by these studies to have a beneficial effect on preventing some forms of cancer, alternate preventive measures should be considered. For example, other sources of vitamin D, either diet or vitamin supplements, should be recommended as a preventive measure. The study by Garland, Shekelle, Barrett-Connor, Criqui and Paul (1985) supports the role of dietary vitamin D in the prevention of colon cancer. They conducted a 19-year prospective study of colon cancer in white men between the ages of 40 and 55 years. The study reported an inverse association between dietary vitamin D consumption

and the incidence of colorectal cancer. Potential overdose toxicity with regard to oral vitamin D supplements can be overcome through consultation with physicians regarding dosage.

It would also appear that sun-mediated photosynthesis of vitamin D can be achieved through normal activities without having to deliberately engage in sunbathing practices. Furthermore, recommendations for sun exposure should include certain sun protection measures which reduce an individual's chance of acquiring skin cancer. For example, it should be recommended that individuals avoid sun exposure between 10 a.m. and 3 p.m. when ultraviolet radiation is most intense and damaging.

It should be noted that, in the present study, the practice of sun protection measures does not imply that an individual should totally avoid any exposure to the sun at all times. However, it does encourage the adoption of adequate and appropriate sun protection measures. Until scientific knowledge can determine what degree of ultraviolet radiation dosage is generally acceptable without causing any significant adverse effects, a more conservative approach to sun protection should be adopted.

Education and Behaviour Change

Information is fundamental to making any sound health-related decision. Accurate knowledge is necessary for making healthy lifestyle choices. It is, however, generally accepted that knowledge per se is not sufficient to stimulate adoption of

appropriate health behaviours (Rudd & Glanz, 1990). Studies on the effects of education on behaviour change towards sun exposure are equivocal. One of the purposes of the Texas statewide campaign in 1988 (Kelly, 1991) was to educate the public concerning prevention and early detection of skin cancer. The targeted populations were adults at their worksites, young children (preschool through 6th grade), and parents. The program used audio-visual and printed materials on prevention, control and recognition of skin cancer. When evaluated by the Texas Poll, the campaign was reported to be successful in increasing the knowledge of skin cancer by 17% over a period of six months. Knowledge about skin cancer in this study pertained to basic facts on skin cancer, importance of sun protection, methods of sun protection, types of skin cancer, and details of ways to recognize melanoma through self-examination. The increased knowledge was accompanied by a self-reported increase of 10% in the number of respondents avoiding exposure to the sun. There was not, however, any behaviour change with regard to sunscreen use (Kelly, 1991).

Other studies on community skin cancer screening have reported encouraging findings verifying that knowledge about the harmful effects of the sun and knowledge of the sun protection factor (SPF) were associated with sunscreen use (Berwick, Fine & Bolognia, 1992). These findings were not supported by Cockburn et al.'s. (1989) study of adolescents' use of sun protection measures in Australia.

Studies that investigated the effects of skin cancer prevention education on patients who had their nonmelanomatous skin cancer surgically removed have also

been carried out. Robinson (1990) studied a group of 1,042 individuals, between the age of 20 and 100 years, who had a nonmelanomatous skin cancer surgically removed. Skin cancer prevention education was provided to every individual in the study group. Robinson found at the end of one year of educational intervention that 62% had complied with recommendations to use sunscreen and 56% had altered their habits of outdoor activity, but 38% had made no changes despite the intense educational programming. The study, however, was unable to determine the effectiveness of the educational intervention per se, because it was not able to control for the possible interaction effect of perceived susceptibility that these subjects might have experienced because of having been treated for nonmelanomatous skin cancer. The change in behaviour witnessed could be due to the contributing effect of perceived susceptibility rather than of education per se.

The uncertainty of the effectiveness of education in behaviour modification in these studies could be a result of the method by which information was communicated.

The Transtheoretical Model of Behaviour Change

Over the past decade, the Transtheoretical Model (stages of behaviour change algorithm) championed by Prochaska and DiClemente (1992) has gained credence in explaining behaviour change, either in the elimination of undesired behaviours or in the adoption of a target behaviour. In their model, Prochaska and DiClemente proposed that behaviour changes follow a dynamic, cyclical process wherein people

progress through a series of stages. Relapse may occur at various stages, resulting in regression to an earlier stage. Considerable research has identified these stages of change, and related constructs that are central to the process of change, in a variety of settings with different problem or target behaviours. Most of the research has been conducted in smoking cessation (Prochaska, Velicer, DiClemente & Fava, 1988; DiClemente et al., 1991; Prochaska, DiClemente, Velicer, Ginpil & Norcross, 1985; DiClemente, Prochaska & Gibertini, 1985). The model, however, has been applied to other areas such as mammography screening (Rakowski et al., 1992), weight loss (O'Connell & Velicer, 1988), psychological distress (Prochaska and DiClemente, 1985), and exercise studies (Marcus, Niaura, & Rossi, 1992; Marcus & Owen, 1992).

Stages of Change in the Model

Horn (1976) introduced the view that health-related behaviour changes proceed through a sequence of specific distinct stages rather than dichotomously. Similar stages of change were identified by DiClemente and Prochaska (1982) in their investigation of smokers who successfully stopped smoking on their own and smokers who stopped smoking through structured treatment programs. These stages of change were: 1) thinking about stopping smoking; 2) becoming determined to stop; 3) actively modifying their habits and/or environment; and 4) maintaining their new habit of not smoking. In later work, Prochaska and DiClemente (1982) renamed these stages as: 1) contemplation; 2) determination (decision making); 3) action; and

4) maintenance. A precontemplation stage preceding the contemplation stage was added to account for individuals who were more resistant to change (Prochaska & DiClemente, 1983).

McConnaught, Prochaska and Velicer (1983) tested the relevance of the stages of change to adult outpatients seeking psychotherapy. A total of 155 subjects receiving therapy from a community facility, private therapist, military counselling centre, or university counselling centre were recruited for the study. A scale called the Stages of Change Questionnaire was devised to measure the five stages: precontemplation, contemplation, decision making, action, and maintenance. One hundred and sixty-five items were generated for the five stages. An inter-rater reliability test requiring 100% agreement between three raters reduced the 165 items to 145. Then, 125 items were selected from the 145 to form the original questionnaire. Finally, a three-stage analysis (based on principal component analysis, Chronbach's coefficient alpha, and item analysis) of the questionnaire resulted in a short, reliable 32-item questionnaire measuring the stages.

The results of the study indicated four distinct stages: 1) precontemplation; 2) contemplation; 3) action; and 4) maintenance. Furthermore, it was found that adjacent stages correlated more highly with each other than with any other stage, suggesting a predictable movement through the stages. The decision-making stage failed to emerge as an independent distinct stage.

A follow-up study designed to cross-validate the stages of change scales using a clinical sample of 327 subjects was undertaken by McConnaughty, DiClemente and

Prochaska (1989). The results of this study verified earlier findings obtained by McConnaughty et al (1983). Other studies that have used the classification schema to investigate a wide range of behaviours have also provided concurring findings, supporting the stages of change as distinct yet related in periods of time, marked by different activities (Prochaska & DiClemente, 1985; Rakowski et al., 1992; O'Connell & Velicer, 1988). Further refinement of the stage model included the addition of a preparation stage. The five-stage model was then defined by Prochaska and DiClemente (1992) as follows:

1) Individuals in the precontemplation stage are unaware or unwilling to change their risk behaviours. They are not convinced that the consequences of the problem behaviour outweigh benefits. They may also believe that the problem behaviour is well controlled and under self-regulation.

2) Individuals in the contemplation stage are actively involved in considering the prospects of change. They tend to engage in information seeking, to reevaluate themselves in light of their problem behaviour, and to evaluate the pros and cons that change would bring. Contemplators are, however, not ready to take action at the time.

3) The preparation stage indicates a readiness to change both attitude and behaviour. These individuals are on the verge of taking action and need to set goals, priorities, and commitments to adhere to the actions they choose.

4) The action stage involves the overt modification of the problem behaviour. Individuals engage in effective behaviour modification strategies to alter their

behaviour and to prevent any relapses back to earlier stages.

5) In Maintenance, the final stage of change, individuals have been successful in altering their problem behaviour for more than six months.

Constructs of Behaviour Change

Behaviour modification techniques like decision making, self-efficacy, expectancies and processes of change have been identified by studies to interact with the stages of change.

Processes of Change

In the pursuit of establishing a more integrative model of behaviour change, Prochaska and DiClemente (1983) noted that there are ten processes of change that are relevant for both self-initiated and therapy-assisted change. These processes of change are identified as:

1) consciousness raising (increasing information about self and problem);

2) counterconditioning (substituting alternatives for problem anxiety-related behaviours);

3) dramatic relief (experiencing and expressing feelings about one's problems and solutions);

4) environmental reevaluation (assessing how one's problems affect the physical environment);

5) helping relationships (being open and trusting about problems with

someone who cares);

6) reinforcement management (rewarding oneself or being rewarded by others for making changes);

7) self-liberation (choosing and committing to act or believe in the ability to change);

8) self-reevaluation (assessing how one feels and thinks about oneself with respect to a problem);

9) social liberation (increasing alternatives for nonproblem behaviours available in society);

10) stimulus control (avoiding stimuli that elicit problem behaviours; adding stimuli that encourage alternative behaviours).

These processes can be classified as either verbal/cognitive or behavioural processes, which are relevant as coping activities for a particular behaviour change. Cognitive processes are more important in preparing an individual for action in the initial stages of change while behavioural processes are more important when an individual has committed himself/herself to act (Prochaska & DiClemente, 1982). Most of the studies investigating the role of these processes have been in smoking cessation (Prochaska & DiClemente, 1983; DiClemente and Prochaska, 1985; DiClemente et al., 1991).

The study by Prochaska and DiClemente (1983) examined the relationship between processes of change and stages of change by studying self-change smokers. A total of 872 subjects from Rhode Island and Texas volunteered for the study. All

subjects were assigned to one of the five stages: 1) Long-Term Quitters (represented the maintenance stage; maintained behaviour change for over six months); 2) Recent Quitters (represented the action stage; quit smoking within six months); 3) Contemplators (seriously thinking about quitting smoking); 4) Immotives (represented the precontemplation stage; no intention to stop smoking in the next year); and 5) Relapsers (failed in attempts to quit smoking within the last year). A 40-item questionnaire measuring the ten processes of change was employed.

Results from the study revealed that precontemplators' use of the processes of change was significantly less than that of individuals in other stages. This suggests that precontemplators process less information about smoking and spend less time re-evaluating themselves as smokers. Contemplators, on the other hand, were more open to information in the form of feedback and education. In fact, individuals in the contemplation and action stages used consciousness raising more than those in the relapse and maintenance stage, with precontemplators using this process the least. Contemplators also reported feeling and thinking of themselves in light of their problem behaviour. Individuals in the action and maintenance stages were found to actively use counter-conditioning and stimulus-control activities to maintain the desired behaviour. In addition, individuals in the action stage were found to use helping relationships and reinforcement processes the most. Finally, relapsers were reported to emphasize change processes that are used in the contemplation stage. In sum, the study showed that processes of change vary in intensity and frequency of occurrence by stage of change; the result is that certain processes are prominent in

distinct stages of change.

A replication of the Prochaska and DiClemente (1983) study was undertaken by Ahijevych and Wewers (1992). Random digit dialling was used to select 190 smokers and ex-smokers. The results lent support to Prochaska and DiClemente's study. The only difference was that social liberation was used more by smokers in the precontemplation, contemplation, and relapse stage than by ex-smokers in these stages. Further concurring evidence of the differential use of change processes at different stages of change was provided by Prochaska et al. (1991) who classified smokers into the precontemplation, contemplation, or preparation stages. They found that individuals in the contemplation stage were the most active in gathering information and evaluating their smoking habits. Individuals in the preparation stage, on the other hand, were more active in modifying their behaviour. The precontemplators were the least likely to engage in most of the change processes.

The stage x process model of behaviour change has also been studied with other problem behaviours. Prochaska and DiClemente (1985) conducted a two year longitudinal study that looked at processes of change in smoking, weight control, and psychological distress. Separate process of change questionnaires, each consisting of 50 items on a 5-point Likert scale, were developed for the three behaviours and administered at different time periods (smoking at twelve months, weight control at eighteen months, and psychological distress at twenty-four months). Only six processes of change, namely consciousness raising, self-liberation, reinforcement management, helping relationships, dramatic relief, and stimulus control, were

utilized in the comparison between the three behaviours.

The results indicated a similar pattern of processes being used in the action stage across the three behaviours, and in the contemplation and maintenance stages between smoking and weight control behaviours. Comparisons with the distress behaviour for the contemplation and maintenance stages were not possible as a result of a printing error in the questionnaire. Differences were noted in the frequency of using the different processes in changing the different behaviours. For example, consciousness raising and self liberation were used more frequently with weight control than with distress, and more frequently with distress than with smoking. The results of this study substantiated the stage by processes model findings in other smoking cessation studies and indicated that distinct processes of change can be identified across different behaviours.

Studies exploring the processes of change in predicting behaviour change over time have also been carried out. A six month follow-up study to determine whether or not processes of change could predict change over time was carried out by DiClemente and Prochaska (1985). They noted that the stages at which the processes are employed are critical in determining successful change. For example, frequent use of the processes of consciousness raising and self-reevaluation in the contemplation stage with smokers was associated with moving from contemplation to action. However, frequent use of these processes in the action stage was associated with relapse. Likewise, frequent use of the helping relationship processes in the action stage by smokers was associated with the likelihood of their moving into

the maintenance stage. It was not, however, associated with change from contemplation to action. Incidentally, to date no processes have been specifically identified as being associated with moving from the precontemplation stage to contemplation. Prochaska and DiClemente (1982), however, suggested that individuals are more apt to contemplate changing their behaviour when developmental processes (moving into a new stage in life) have occurred and/or when the individual's environment has changed substantially.

Decision Making

Janis and Mann (1977) have shown that decision making processes play a major role in behaviour change. Individuals involved in any form of behaviour change have been shown to engage in evaluating the pros and cons of eliminating/adopting a target behaviour. A wide range of studies across different behaviours have established the role of decision making in behaviour change (DiClemente et al., 1991; Prochaska, DiClemente, Velicer, Ginpil & Norcross, 1985; O'Connell & Velicer, 1988; Rakowski et al., 1992).

These studies have established distinct patterns of interaction between decision making and stages of change. It has been demonstrated that the pros-and-cons evaluation for eliminating or adopting a behaviour was most pronounced in the precontemplation, contemplation and preparation stages. In the precontemplation stage, the pros for maintaining an undesired behaviour appear to be highest. When an individual progresses to the contemplation stage the pros remain more prominent

than the cons although less salient when compared to the precontemplation stage. In the latter stage of preparation and during action, the cons become more prominent. The consideration of pros and cons takes a less salient role in the maintenance stage with the cons remaining stronger than the pros.

Self-Efficacy

The work of Bandura (1977) on self-efficacy suggests that a person's perceived ability on a given task will mediate future attempts to engage in that task. In his later work, Bandura concluded that the bridge between knowledge and action in performing a particular task lies with an individual's self-referent thought (Bandura, 1986). In accordance with his social cognitive theory, self-efficacy evaluation plays a crucial role in effort expenditure, choices, emotional reactions, and behavioural performance. The role of self-efficacy has been acknowledged to be a predictor in behaviour change. Like the decision-making construct, self-efficacy has been shown by studies to interact with stages of change in a specific manner (DiClemente, Prochaska & Gibertini, 1985; Marcus & Owens, 1992; DiClemente & Hughes, 1990).

The study by DiClemente, Prochaska, and Gibertini (1985) examined the relationship between self-efficacy and self-change in smoking behaviour. Nine hundred and fifty-seven subjects were recruited. These subjects represented five stages of self change: 1) Immotives were subjects who were currently smoking, had not attempted to quit smoking over the last year, and had no intention of quitting in the next year; 2) Contemplators were subjects who were similar to immotives except

that they were seriously contemplating quitting smoking in the next year; 3) Recent quitters were subjects who were currently not smoking and had quit and maintained nonsmoking status for any period greater than one day and less than six months prior to initial assessment; 4) Long-term quitters were subjects who had quit smoking and maintained nonsmoking status for six months or more prior to initial assessment; and 5) Relapsers were subjects who reported that they currently smoked but had tried to quit smoking and had been abstinent for a minimum of a day at least once in the year prior to initial assessment. A 31-item questionnaire measuring self-efficacy was employed. The questionnaire contained questions that rated both temptation (cue strength) and confidence (efficacy). The study found that the level of self-efficacy was low in subjects who were classified as immotives, contemplators, and relapsers. In contrast, subjects who were classified as recent quitters and long-term quitters scored high in self-efficacy.

When epidemiologic studies revealed that most cancers were preventable and that lifestyle changes were one of the major factors in reducing the risk of cancer, behavioural research became identified as a priority (Shiffman et al., 1991). The rapid movement toward conducting prevention programs, however, left gaps in the knowledge of behaviour and behaviour change processes (Shiffman et al., 1991). This study is an endeavour to gain some insights on the behaviour change process of consciousness raising as it relates to sun protection behaviours. Hence, the stages of behaviour change forms the theoretical framework for the study.

CHAPTER THREE

METHODOLOGY

Introduction

This chapter describes the study design, procedures, instruments, and data analysis techniques that were utilized in the study. A brief description of the study sample is also included to provide a better appreciation of the study population.

Design

The study utilized the baseline and twelve-month data from the Alberta Cancer Board's (ACB) "Cancer Prevention in the Workplace" project. The study design is therefore based on the ACB study - a randomized controlled intervention trial.

"Cancer Prevention in the Workplace" Study Design

The objectives of the ACB project were twofold. First, to determine whether or not personalized advice on cancer risk reduction led to: 1) increased knowledge of cancer risk factors, 2) movement between stages of behaviour change, and 3) changes in selected risk behaviours. Second, to determine whether or not changes in knowledge, behaviour, and stages of behaviour change differed with the different modes of intervention delivery. These mechanisms of delivery were: 1) risk

assessment questionnaire and mailed personalized letter feedback, 2) computerized risk assessment with interactive computer feedback, or 3) computerized risk assessment with both interactive computer feedback and mailed personalized letter feedback. In addressing these questions, the project would be able to ascertain if minimal level intervention is effective in helping individuals reduce their risk of developing cancer. The study is significant because it addresses three pertinent issues in health promotion and prevention: health promotion in the worksites, prevention of cancer, and the use of computers to deliver health interventions to the public.

Selection of worksites for the study was contingent upon a worksite possessing multiple departments and upon the ability and willingness of the worksites to offer either the questionnaire or the computer version of the intervention. The departments chosen were required to have between 100 and 300 employees with similar gender, age, and education distribution. Furthermore, it was required that there be minimal interaction between individuals from separate departments to prevent possible contamination of the intervention. Hence, only geographically or organizationally independent work groups such as departments or floors were eligible.

A one stage cluster sampling design was utilized to randomly select and assign each department within a corporation to one of the three study intervention groups or to the control group. Although this sampling design is less efficient than individual randomization, it was chosen for the purposes of avoiding treatment contamination, reducing cost, and easing administration of the study. Further

discussion of the effects of a one stage cluster sampling design is provided in the section, "Caveats of the Study" (Chapter V, p. 109).

Seven worksites/corporations in Calgary were eligible and interested in the project. A total of 3,340 employees from these worksites were invited to participate in the study. A response rate of 59% (1,987 employees) was obtained and the worksites were enrolled in two phases. The first enrolment consisted of 885 participants from two corporations; the second included 1,102 participants from five corporations. Subjects for this self-reported study were selected based on their eligibility and their willingness to participate. Appendix A contains a sample of the information sheet, consent form, and non-participation form that subjects received.

For the individuals receiving the first intervention (letter feedback), the Risk Assessment questionnaires were distributed to the participants, who were encouraged to complete and return them to the study centre. A personalized letter describing an individual's risk profile and containing suggestions for reducing his/her cancer risk was then generated and mailed back to the participants' homes. For the individuals receiving the interactive computer feedback, a simulated "live" consultant interview was employed. A computer program provided on diskette, which asked similar information as in the written Risk Assessment questionnaire, was administered. The program asked questions and provided feedback in a conversational dialogue using the user's first name. Immediate personalized advice and suggestions for reducing an individual's cancer risk were offered as the risk information was being solicited. A summary of all risk reduction advice was also provided at the conclusion of the

program. Participants in the third intervention (interactive computer and letter feedback) group received both the interactive computer program and a mailed letter (Figure 1). The treatment for these three intervention groups was introduced only after the baseline measure was collected. Follow-up data collection was carried out after six months and twelve months. The participants in the control group did not receive the intervention until their twelve-month data were collected. In the first phase of the study (n=885), departments from each of the two corporations were randomly assigned to the three intervention groups and to the control group in such a way that each intervention group and the control group comprised two departments, one from each of the two corporations.

Procedures

The present study utilized only data that were collected at the baseline and twelve-month data points from the first two corporations (n=885). Data from only these two time periods were analyzed in an attempt to address the previously stated research questions. This decision was primarily a result of the lack of information available in the six-month data set. For example, the six-month questionnaire did not contain the questions required to classify subjects into stages of change according to the algorithm (Figure 2). Consequently, analysis comparing movement between stages of change over time is not possible. Likewise, information relating to the subjects' beliefs regarding cancer was not available, hindering any measure of change in belief comparisons over time.

Figure 1

Cancer Prevention in the Workplace Study Design

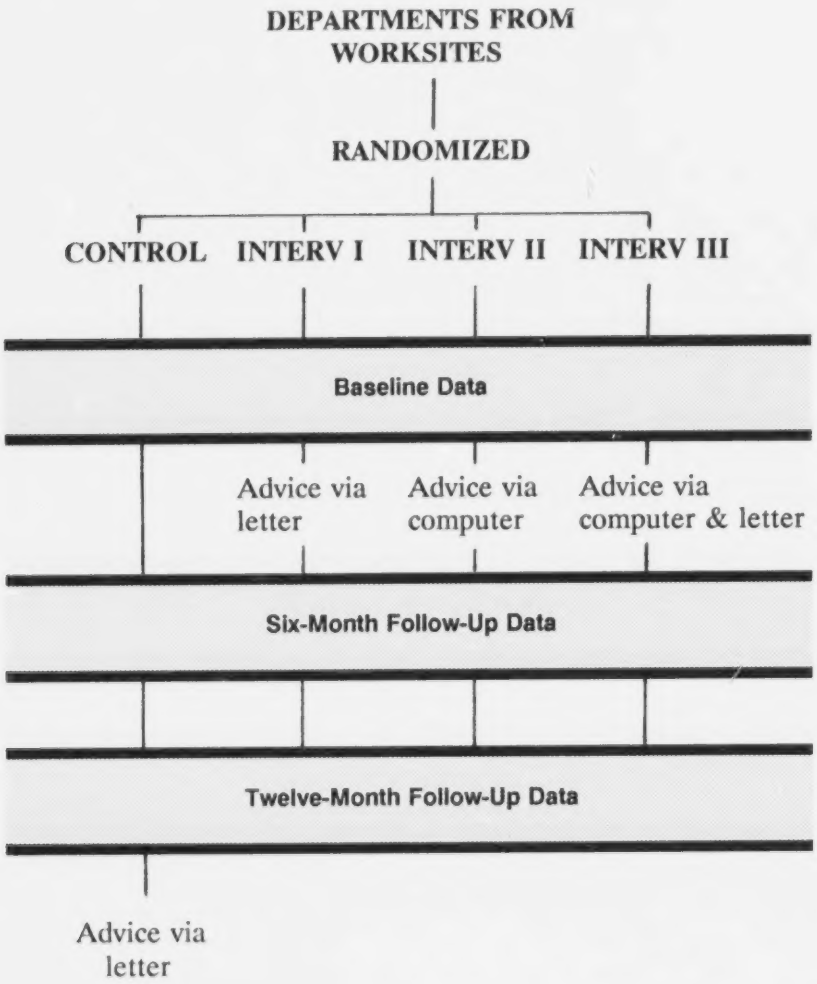
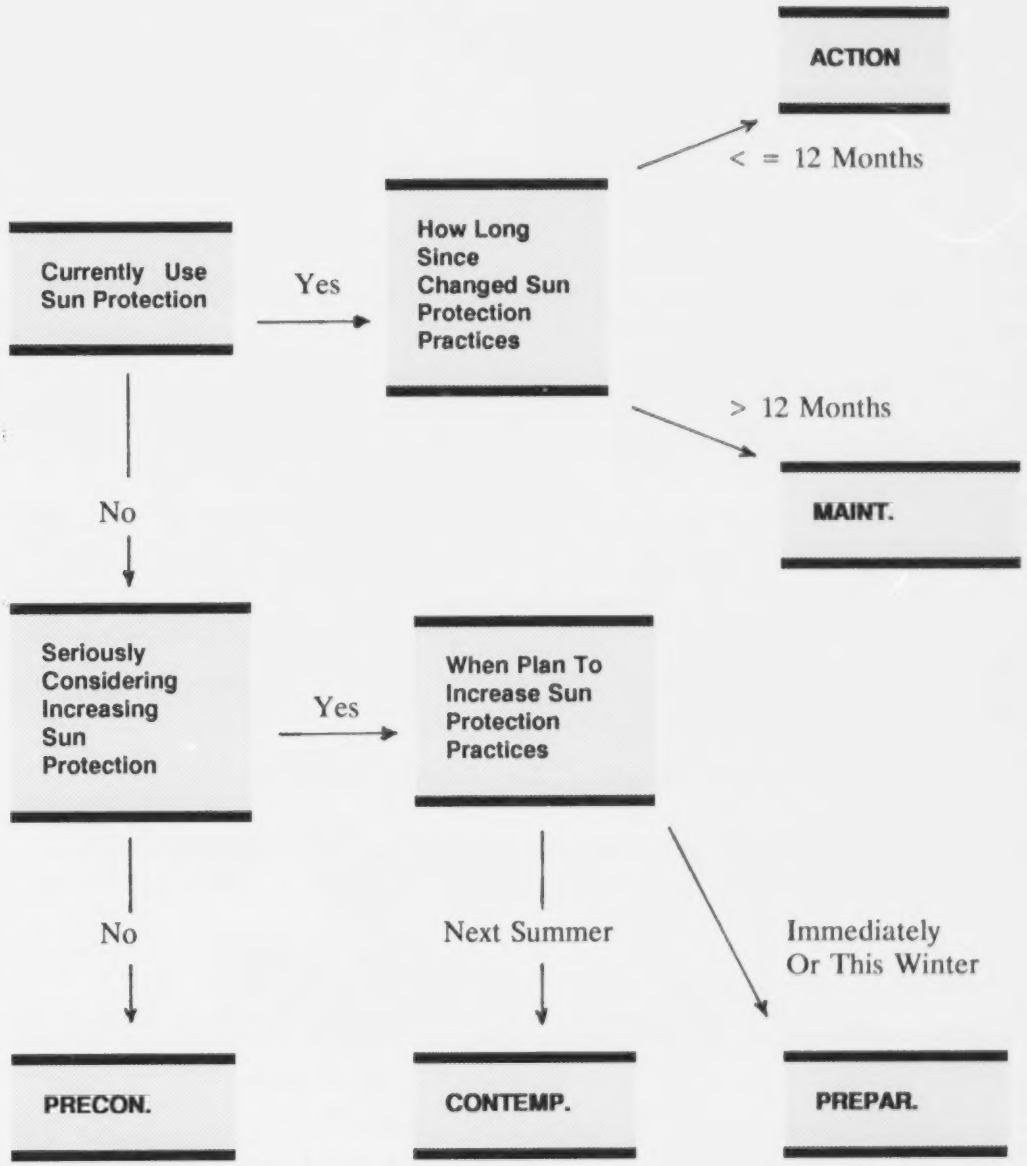


Figure 2

Staging Algorithm For Sun Protection Behaviour



Note: Precon.= Precontemplation, Contemp.= Contemplation, Prepar. = Preparation, Maint.= Maintenance

Study Sample

Of the 885 subjects who participated in the study, 6 subjects (0.7%) failed to complete the Lifestyle questionnaire, and 146 subjects (16.5%) were lost to follow-up by the twelve-month period. The study utilized only those subjects who completed all the questionnaires at the baseline and twelve-month periods. The sample size for the study was therefore reduced to 733 subjects, 514 of whom received treatment after the baseline data were collected and 219 subjects who received the treatment after the twelve-month data were collected. Subjects were between the ages of 21 and 63 years.

A descriptive statistical analysis on gender, age, education, and marital status of the subjects (Table 1) who completed the study (n=733) and the subjects who were lost to follow-up (n=146) was performed. This analysis was carried out to determine if the subjects who were lost to follow-up were different from subjects who completed the study. Comparisons on gender found the two groups to be comparable (Table 1). Females who were separated, divorced or widowed and between the ages of 21 and 29 were more likely to be lost to follow-up. On the other hand, males who possessed a university certificate and/or diploma but did not have a degree were found to be more likely to be lost to follow-up. Both the complete follow-up and attrition groups were found to be comparable in the stages of behaviour change (Table 2).

The overall mean age for both groups was 37 years. The age range for the complete follow-up group was 21 and 63 years; the age range for the attrition group

Table 1
Comparisons Between Complete Follow-Up and Attrition Subjects on Demographics

	Complete Follow-Up (n=733)		Attrition (n=146)	
	Male (n=385) n (%)	Female (n=348) n (%)	Male (n=81) n (%)	Female (n=65) n (%)
Gender	385 (52.5)	348 (47.5)	81 (55.5)	65 (44.5)
Marital Status				
Married/Common Law	305 (95.3)	220 (86.0)	64 (95.5)	30 (69.8)
Sep/Div/Wid.	15 (4.7)	36 (14.0)	3 (4.5)	13 (30.2)
Total	320 (100)	256 (100)	67 (100)	43 (100)
Age Groups				
21 - 29	45 (12.1)	75 (12.9)	11 (14.1)	16 (25.0)
30 - 39	175 (46.9)	160 (54.8)	39 (50.0)	25 (39.1)
40 - 49	117 (31.3)	89 (26.0)	23 (29.4)	20 (31.3)
50 - 59	35 (9.4)	13 (3.0)	5 (6.4)	1 (1.6)
60 - 63	1 (0.3)	5 (1.5)	0 (0.0)	2 (3.1)
Total	373 (100)	342 (100)	78 (100)	64 (100)
Education				
No formal education	4 (1.0)	17 (5.1)	4 (5.3)	5 (7.9)
Certificate/Diploma	40 (10.5)	110 (33.1)	15 (19.7)	23 (36.5)
> 1 < deg./U Cert/Dipl.	79 (20.7)	86 (25.9)	29 (38.1)	7 (11.1)
Degree or higher	258 (67.7)	119 (35.9)	28 (36.9)	28 (44.5)
Total	381 (100)	332 (100)	76 (100)	63 (100)

Note: Sep/Div/Wid. = Separated or Divorced or Widowed;
> 1 < deg./U Cert/Dipl. = more than 1 year of university education but no bachelor degree or university certificate and/or diploma

Table 2
Comparisons Between Complete Follow-Up and Attrition Subjects on Stages of Behaviour Change at Baseline

	Complete Follow-Up		Attrition	
	Male (n=292) n (%)	Female (n=222) n (%)	Male (n=81) n (%)	Female (n=65) n (%)
Stages of change				
Precontemplation	109 (39.6)	56 (26.8)	27 (34.6)	19 (30.6)
Contemplation	53 (19.3)	69 (33.0)	16 (20.5)	20 (32.3)
Action	4 (1.5)	9 (4.3)	0	0
Maintenance	109 (39.6)	75 (35.9)	35 (44.9)	23 (37.1)
Total	275 (100)	209 (100)	78 (100)	62 (100)

was 24 and 60 years. Overall, the letter group showed the highest attrition (32.2%) and the computer and letter group showed the lowest (18.5%). The control and computer groups were comparable in their rates of attrition (24.0% and 25.3%, respectively).

Instrument

Two sets of self-administered questionnaires were used across two time periods to obtain information for this study. As noted above, the six-month questionnaire was not utilized in the present study, and is omitted from the analyses.

The Risk Reduction Behaviour questionnaire and the Lifestyle questionnaire were administered at the baseline phase. The Risk Assessment questionnaire

contained questions on: personal health history; family history of cancer; eating habits; exercise routines; smoking history; certain phenotypes of individuals; sun exposure history; and questions on the practice of Pap Test and breast self-examination. The Lifestyle questionnaire collected data on: background information; knowledge, attitudes, and beliefs about cancer; stages of behaviour change as it related to smoking habits; sun exposure habits; weight reduction and breast self-examination; and risk behaviours ranging from smoking habits to sun exposure practice. The twelve-month questionnaires contained follow-up questions to those asked at the baseline period.

This study used questions, particularly those related to sun exposure and skin cancer, from these questionnaires. Details of the questions and the scales used by these questions are presented in Appendix B. The following measures were used for the above questionnaires.

1) Risk Behaviour Questions.

Wherever possible, these questions assessing risk behaviours have been derived from other health surveys with known reliability and validity. The test-retest reliability on sun exposure items calculated on Alberta adults between the ages of 18 and 43 years (mean=25.2) was r = 0.88. Strong face validity has also been suggested by the level of agreement among persons receiving personalized advice generated from the risk assessment in both the Steve Fonyo Cancer Control and Prevention Program and the "Cancer Me??" feasibility study.

2) General Cancer Risk Knowledge Questions.

The ACB has adopted the general cancer risk knowledge questions from Stone and Siegel (1986) for their study "Cancer Prevention in the Workplace". The present study has chosen only those knowledge questions related to causes of, cures of, and preventive behaviours of skin cancer from the ACB's questionnaire. Stone and Siegel developed the twenty-three item questionnaire addressing knowledge of causes of cancer, chances of curing common cancers, and the benefits of various behaviours in reducing cancer risk. The questions were on a four point scale: "great extent", "somewhat", "not very much" and "not at all". The questionnaire has a moderate degree of overall internal consistency among the items (Chronbach's alpha=0.50). A factor analytically derived subscale concerning "belief about cure" showed higher internal consistencies (Chronbach's alpha=0.70). The questionnaire was found to be correlated with expected demographic and lifestyle variables, suggesting some degree of concurrent validity. Minor modifications to the scale were made to make it suitable to the Alberta context. High reliability for the three subscales was obtained based on calculations using the Steve Fonyo Cancer Control and Prevention Program baseline data. The alpha coefficients for causes of cancer, cures of cancer, and preventive behaviours were 0.85, 0.74 and 0.80, respectively. This questionnaire was also utilized by the Steve Fonyo Cancer Prevention Program.

3) Stages of Behaviour Change Questions:

This assessment is based on the work of Prochaska and DiClemente (1984). It is based on a determination of what actions in the risk area the individual has taken in the recent past, is currently doing, is thinking of doing in the near (6 months) or distant (12 months) future. These variables are used to categorize participants into one of the five stages of behaviour change, namely precontemplation, contemplation, preparation, action, and maintenance. The questions used for categorizing participants require "yes" or "no" answers or require subjects to fill in time periods in weeks, months and/or years. Construct and predictive validity of stage classification have been established by a number of authors for different behaviours: smoking (DiClemente & Prochaska, 1985); mammography (Rakowski et al., 1992); and weight loss (O'Connell & Velicer, 1988).

4) Attitudes To Cancer Questions.

This questionnaire was developed by Dent and Goulston (1982). They identified four independent dimensions of public attitudes to cancer: anxiety, denial, fatalism about control, and fatalism about prevention. A five-point Likert scale consisting of "strongly agree", "tend to agree", "uncertain", "tend to disagree", and "strongly disagree" was used for all the questions, acquiring information on each of the four attitude dimensions. These factor analytically derived dimensions showed moderate correlation for anxiety ($r = 0.37$), denial ($r = 0.27$), fatalism about prevention ($r = 0.36$), and fatalism about control

(r=0.40). Test-retest reliability was high in every case: anxiety (r=0.74), denial (r=0.74), fatalism about prevention (r=0.72), and fatalism about control (r=0.74).

The present study adopts the stages of behaviour change staging algorithm based on the Alberta Cancer Board's operational definition (Figure 2). Four questions related to stages of change were used at baseline and at the twelve-month period to classify subjects into one of five stages of change.

Subjects were asked the question, " Do you currently use sun protection (wearing sunscreen, wearing a hat, and wearing long sleeves and pants) when exposed to sunlight for extended periods?" If a subject responded "yes" to this question, the following question, "How long ago did you change (increase) your sun protection practices?", determined whether he/she was classified in the action or maintenance stage. A response of greater than twelve months assigned the subject to the maintenance stage. Any other duration stated, twelve months or less, assigned him/her to the action stage. If, however, the subject responded "no" to the initial question, then the subsequent question was, "Are you seriously considering using increased sun protection?" A "no" response assigned the subject to the precontemplation stage. Otherwise, the subject was asked, "When do you plan on increasing your sun protection practices?" If the subject responded by choosing the option "next summer" (six months' time), he/she was assigned to the contemplation stage. If, however, he/she chose the options "immediately or this coming winter (one

month's time)", he/she was assigned to the preparation stage.

Data Analysis Techniques

Descriptive statistics on demographic variables were performed to describe the study sample. As well, mean response scores on the variables of interest within categories defined by the demographic variables were presented. Most behaviour studies have found difference in responses between genders. In addition, examination of the baseline data for the study indicated gender differences in the practice of sun protection behaviours. Accordingly, the data for males and females were analyzed separately for all the research questions. The relation between the variables of interest and other demographic variables such as age, education, and marital status were not examined in detail by this study. Although the relationships between these variables warrants investigation, it is beyond the scope of this study.

The measurement scales on questions related to certain study variables were condensed to provide more manageable and meaningful information and to ensure adequate numbers in each category of the scale for statistical analysis purposes.

The measurement scales on questions related to sunscreen use, wearing a hat, wearing protective clothing, and avoiding the sun were condensed. The original four-point scale consisting of "always", "usually", "sometimes", and "never" was transformed to a two-point scale - "frequent" and "infrequent". The "frequent" scale is comprised of the "always" and "usually" categories, and the "infrequent" scale is comprised of the "sometimes" and "never" categories. In targetting a population for behaviour change

relating to skin cancer, the interest is in identifying populations that are frequent or infrequent in their practice of sun protection behaviours.

The scoring system for the knowledge questions was adopted from the Stone and Siegal (1986) study. Responses on the knowledge questions were scored in graduated units, with correct, partially correct and incorrect answers receiving two, one and zero points, respectively. The question on the importance of avoiding sun exposure in reducing skin cancer was coded as follows: a response of "somewhat important" was coded as two, a response of "not too important" was coded as one. All other responses were considered incorrect and were coded as zero. For the question on how much family history affects the chances of getting cancer, a response of "somewhat" was coded as two, a response of "great extent" or "not much" was coded as one, and the response of "not at all" was coded as zero. For the question on how much sun exposure affects the chances of getting cancer, a response of "great extent" was coded as two, a response of "somewhat" was coded as one, and other responses were coded as zero. For the last question on the chances of curing skin cancer if it is detected early, a response of "good" was coded as two, a response of "excellent" or "fair" was coded as one, and a response of "poor" was coded as zero. The three knowledge questions on importance in reducing skin cancer, chances of getting skin cancer, and curability of skin cancer were combined after subjects' responses were recoded. The range of scores from zero to eight were split into two dichotomous categories by choosing a point that best approximated the fiftieth percentile (median). Data on the distribution of knowledge responses for both time

periods are found in Appendix C. Thus, a score between zero and four was classified into the category of low knowledge; a score between five and eight was classified into the category of high knowledge. The decision to reduce the knowledge scale to two categories was made to ensure a sufficient number of subjects in each cell, thus facilitating statistical analysis.

For the attitude variable, the scoring for all the questions was reversed except for the question, "I have never worried that I might have cancer." Therefore, a lower value means "disagree" and a higher value means "agree". Dent and Goulston's (1984) scoring system was used to combine appropriate questions to obtain attitude scores pertaining to anxiety, denial, fatalism about prevention, and fatalism about control (Appendix B). The scores between three and fifteen, for each of the attitudes, were split into two categories by choosing a point that best approximated the fiftieth percentile (median). Data on the distribution of attitudes responses for both time periods are found in Appendix C. The mean score was not selected as the cut-off point because the distribution of scores for the "fatalism about prevention" and "fatalism about control" variables were positively skewed. The cut-off points for the four attitudes, for baseline and twelve months, were as follows:

a) anxiety: score of 3 to 8: "low", score of 9 to 15: "high"

b) denial: score of 3 to 7: "low", score of 8 to 15: "high"

c) fatalism about prevention: score of 3 to 6: "low", score of 7 to 15: "high", and

d) fatalism about control: score of 3 to 6: "low", score of 7 to 15: "high".

The categories "low" and "high" corresponded to the terms "disagree" and "agree".

The decision to collapse the range of scores to a two-point scale ensured a sufficient number of subjects in each cell to facilitate statistical analysis.

The categories for the belief variable were condensed from five categories to three. The categories "definitely not" and "unlikely" were collapsed to form the category "unlikely". Similarly, the categories "definitely" and "likely" were collapsed to form the category "likely". The category "50/50 chance" remained unchanged.

The stages of behaviour change staging algorithm was reduced from five stages to four. The contemplation stage was combined with the preparation stage and named the contemplation stage. The revised stages of behaviour change staging algorithm hence consisted of the precontemplation, contemplation, action, and maintenance stages. The decision to combine the contemplation and preparation stages was made because of the small sample size found in the preparation stage. The comparable characteristics of these two stages also facilitated the collapsing of these stages. Furthermore, collapsing these two stages would provide a more accurate account of subjects' sun protection behaviours because seasonal variation would be accounted for. Since the data were collected in early winter, the behaviours practiced could be due to protection against the cold rather than against sunshine.

The categories for questions related to eye and hair colours likewise were condensed. The new scales consisted of light or dark eye colour. Subjects with blue, green or grey eye colour were classified as having "light eye colour" and subjects with hazel, brown or dark eye colour were classified as having "dark eye colour".

Similarly, hair colours were condensed into two categories - light and dark hair colour. Subjects with blond or red hair were classified as having "light hair colour" and subjects with light brown, dark brown or black hair were grouped under "dark hair colour".

Finally, based on the self-report of subjects regarding the number of educational qualification(s) they possess, four categories for the education variable were derived. The first category, "none", represented subjects with no formal education. The second category, "certificate/diploma", consisted of subjects who possessed a combination or any of the following: high school diploma, trades certificate or diploma, or other non-university certificate or diploma. The third category, "degree", consisted of subjects who possessed more than one year of university education but not a bachelor degree, or university certificate or university diploma below a bachelor degree. The last category, "bachelor degree or higher", consisted of subjects who had a bachelor degree, postgraduate degree, or other qualifications.

Four new variables - namely change in sunscreen use, change in wearing a hat, change in wearing protective clothing, and change in avoiding the sun - were created to facilitate statistical analyses carried out by the study. These variables were classified on a three-point scale (nominal measurement) based on a change or absence of change from baseline to the twelve-month period in each of the behaviours. Hence, the categories consist of "increase", "no change", and "decrease" as they pertain to the frequency of practicing a particular sun protection behaviour.

Chi square nonparametric statistics were utilized for analyzing all the research questions. This statistical tool was selected because of the ordinal and nominal level of measurement that typified the data. Furthermore, the groups involved in the comparisons were independent.

Preliminary analysis using the Mantel-Haenszel chi-square test for linear association was performed to address whether or not changes in each of the sun protection behaviours differed with different modes of intervention delivery. For this test, cross-tabulation between the intervention (letter, computer, and computer and letter) and control groups and the change in each of the sun protection behaviours (increase, no change, decrease) was carried out separately for each gender. The results indicated that the intervention groups were not statistically different in their effectiveness in facilitating change in sun protection behaviours. The detailed results of this analysis are presented in the section "Justification For Combining The Intervention Groups" (Chapter IV, p. 62). Based on these findings, a decision was made to combine the three intervention groups into a single group for all analyses related to study interventions.

For the first research question, whether or not sun protection behaviours changed over time with the provision of personalized advice, descriptive statistics reporting the frequency of practising sun protection behaviours at both time periods were presented. Thereafter, the Mantel-Haenszel chi-square test for linear association was employed to determine if the intervention and control groups were statistically different with respect to changes in each of the sun protection behaviours.

For the second research question, cross-tabulation and Goodness-of-Fit chi-square statistics were used to investigate whether or not frequent and infrequent practicers of sun protection behaviours differed in knowledge, attitudes, and beliefs.

For the third research question, the distribution of subjects in each of the stages of behaviour change at both time periods, and of percentage change in movement between stages over time, were reported. The Mantel-Haenszel chi-square test for linear association was employed to determine whether or not subjects from the intervention and control groups were statistically different in the direction of movement or lack of movement from one stage to another. In cross-validating subjects' self-reports regarding their sun protection behaviours and their reported change concerning sun protection, cross-tabulations and Goodness of Fit chi-square tests were used.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents descriptions of the demographic, phenotypic, and health profiles of the sample population. Description of demographic characteristics by variables of interest (i.e., sun protection behaviours, knowledge, attitudes, and beliefs) are also presented. In addition, findings related to the three research questions are reported and discussed.

General Profile of the Sample by Gender

Demographic and Classification Profile by Gender

The information on the demographic characteristics of the sample is presented in Table 3. Of the entire study sample of 733 subjects, 385 (52.5%) subjects were males and 348 (47.5%) subjects were females. The majority of the sample from both genders were married or living in common law relationships (95.3% males, 86.0% females). The mean age of the sample was 38 years and the range was 21 and 63 years. A greater proportion of males than females held a bachelor degree or higher (67.7% vs 35.9%, respectively).

With the exception of the computer and letter group (17.1%), the subjects were relatively evenly distributed across the specific treatment modalities (letter,

Table 3
Demographic Characteristics of the Sample

	Sample (n=733)	
	Male (n=385) n (%)	Female (n=348) n (%)
Marital Status		
Married/Common Law	305 (95.3)	220 (86.0)
Separated/Divorced/Widowed	15 (4.7)	36 (14.0)
Total	320 (100)	256 (100)
Age Groups		
21 - 29	45 (12.1)	75 (21.9)
30 - 39	175 (46.9)	160 (54.8)
40 - 49	117 (31.3)	89 (26.0)
50 - 59	31 (9.4)	13 (3.8)
60 - 63	1 (0.3)	5 (1.5)
Total	373 (100)	342 (100)
Education		
No formal education	4 (1.0)	17 (5.1)
Certificate/Diploma	40 (12.3)	110 (33.1)
> 1 < degree/U. Cert/Dipl.	79 (18.9)	86 (24.4)
Bachelor degree or higher	258 (67.7)	119 (35.9)
Total	381 (100)	332 (100)

Note: > 1 < degree/U. Cert/Dipl. = more than 1 year of university education but no degree and/or university certificate or diploma

26.5%; computer, 26.6%; and control, 29.9%). In table 4, the computer, and computer and letter groups are shown to have an overpresentation of males while the control group has a higher proportion of females. Subject representation from the two participating corporations were comparable, with the first corporation accounting for 52.0% of the study population. Similarly, gender representation from each of the corporations was comparable, with males accounting for slightly more than half of the sample in each case (Table 4).

Table 4
Distribution of Study Interventions and Worksite Groups

	Sample (n=733)		
	Male (n=385) n (%)	Female (n=348) n (%)	Total
Intervention Groups			
Control	93 (42.5)	126 (57.5)	100%
Letter	100 (51.5)	94 (48.5)	100%
Computer	116 (59.5)	79 (40.5)	100%
Computer and Letter	76 (60.8)	49 (39.2)	100%
Worksites			
Corporation 1	203 (53.3)	178 (46.7)	100%
Corporation 2	182 (51.7)	170 (48.3)	100%

Phenotypic and Medical Profile of Sample by Gender

A detailed presentation of phenotypic profile by gender for the sample is found in Table 5. The literature on risk factors for nonmelanomatous and malignant melanomatous skin cancer has identified high-risk individuals as those who have light eye, hair, and skin colours, and who have a tendency to burn when exposed to sunshine for prolonged periods (Evans et al., 1988; Lee, 1989; Herity, O'Loughlin, Moriarty & Conroy, 1989; Gafa et al., 1991). More than 60% of the males did not possess any of these risk factors, with the exception of light eye colour (55.0%). The majority of the females possessed the light skin colour risk factor (50.9%). The reports on skin colour by both genders appear to concur with the reports of their skin reaction to one hour of unprotected sunlight. A higher proportion of females than males reported always or usually burning rather than tanning when exposed unprotected to sunlight for prolonged periods (43.1% vs 27.2%, respectively).

The subjects in the sample were in good health. More than 90% of the sample reported themselves to be in good or excellent general health without any serious health problems, including not suffering from dysplastic nevus syndrome or cancer.

Mean Responses On Variables Of Interest By Demographics

The mean score distributions between variables of interest (sun protection behaviours, knowledge, attitudes, and beliefs) and demographics (gender, age, education, and marital status) are presented in tables 6A to 9D in Appendix D.

Table 5
Phenotypical Characteristics of the Sample by Gender

	Sample (n=733)	
Phenotypes	Male (n=385) n (%)	Female (n=348) n (%)
What colour are your eyes?		
Light eye colour	210 (55.0)	163 (46.8)
Dark eye colour	174 (45.0)	185 (53.2)
Total	384 (100)	348 (100)
What is your natural hair colour?		
Light hair colour	57 (14.8)	55 (15.8)
Dark hair colour	327 (85.2)	293 (84.2)
Total	384 (100)	348 (100)
How would you describe your skin colour?		
Light or fair	137 (35.7)	177 (50.9)
Medium	211 (54.9)	156 (44.8)
Dark	36 (9.4)	15 (4.3)
Total	384 (100)	348 (100)
Skin reaction to one hour of unprotected sunlight		
Always burn, never tan	37 (9.7)	57 (16.4)
Usually burn, never tan	67 (17.5)	93 (26.7)
Sometimes mild burn, average tan	187 (49.0)	141 (40.5)
Rarely burn, tan with ease	91 (23.8)	57 (16.4)
Total	382 (100)	348 (100)

a) Sun Protection Behaviours

Out of the possible range of scores between 1 and 4 ("always" to "never"), the actual mean scores indicate that subjects often practiced sun protection behaviour (Tables 6A to 6D). Notable exceptions were: i) that, whereas females at baseline often used sunscreen, females at twelve months usually used sunscreen; ii) that subjects 50 to 63 years of age usually wore a hat at both baseline and twelve months, and protective clothing at twelve months, and subjects 21 to 39 years of age usually used sunscreen; iii) that subjects who were married, separated, divorced and widowed usually used sunscreen at twelve months.

b) Knowledge About Skin Cancer

Out of the possible range of scores between 0 and 8 ("low" to "high"), the actual mean scores indicate that subjects were slightly above (a score of 5) the midpoint on the scale of knowledge score across the different demographic variables (Tables 7A to 7D).

c) Attitudes About Cancer

Out of the possible range of scores between 3 and 15 ("low" to "high"), the actual mean scores indicated that subjects tended generally to be moderately anxious (a score of 8), low on denial (a score of 7), less fatalistic about prevention (a score of 6), and less fatalistic about control (a score of 7) across the different demographic variables (Tables 8A to 8D).

d) Beliefs About Cancer

Out of the possible range of scores between 1 and 5 ("definitely not" to

"definitely"), the actual mean scores indicate that subjects were uncertain about their chances of getting cancer at some point in their lives (Tables 9A to 9D).

Justification For Combining The Intervention Groups

A preliminary examination of whether the three intervention groups (i.e., letter, computer, and computer and letter) differed in their effectiveness in creating a change in sun protection behaviours was undertaken prior to reporting the results of the research question. Based on the findings, a decision was made to combine the three intervention groups, treating them as a single intervention group, rather than to examine the three intervention groups separately.

An examination of table 10 (for males) and table 11 (for females) indicates that the three intervention delivery groups for males show minor differences in their effectiveness in facilitating change in sun protection behaviours. Comparisons across the three intervention groups in the practice of the four sun protection behaviours found the computer group to display the highest percentage of increase change. The Mantel-Haenszel chi-square test for linear association, however, found that the changes in behaviours were not statistically significantly different between the three modes of intervention delivery. The respective chi-square values for sunscreen use, wearing a hat, wearing protective clothing, and avoiding the sun were χ^2 (1)=0.00, p=0.99; χ^2 (1)=0.13, p=0.72; χ^2 (1)=0.12, p=0.73; and χ^2 (1)=0.01, p=0.93, respectively. Similarly, for females (Table 11), the computer group showed the highest proportion of increase change across the four sun protection behaviours.

Table 10
Comparisons of Intervention Groups on Change in Behaviours For Males

	Intervention Groups (n=292)			
Change in Behaviour	Letter (n=100) n (%)	Computer (n=116) n (%)	Computer & Letter (n=76) n (%)	Total n (%)
Sunscreen use				
Increase	11 (26.2)	19 (45.2)	12 (28.6)	42 (100)
No change	80 (36.7)	84 (38.5)	54 (24.8)	218 (100)
Decrease	8 (26.7)	12 (40.0)	10 (33.3)	30 (100)
Total	99	115	76	290
Wearing a hat				
Increase	13 (32.5)	16 (40.0)	11 (27.5)	40 (100)
No change	81 (34.5)	95 (40.4)	59 (25.1)	235 (100)
Decrease	4 (28.6)	4 (28.6)	6 (42.9)	14 (100)
Total	98	115	76	289
Wearing protective clothing				
Increase	18 (34.6)	21 (40.4)	13 (25.0)	52 (100)
No change	75 (33.6)	90 (40.4)	58 (26.0)	223 (100)
Decrease	5 (35.7)	4 (28.6)	5 (35.7)	14 (100)
Total	98	115	76	289
Avoid the sun				
Increase	10 (34.5)	11 (37.9)	8 (27.6)	29 (100)
No change	84 (35.1)	91 (38.1)	64 (26.8)	239 (100)
Decrease	6 (26.1)	13 (56.5)	4 (17.4)	23 (100)
Total	100	115	76	291

Note: The total number of subjects for each behaviour do not sum up to (n=292) as a result of missing observations from statistical analyses.

Table 11
Comparisons of Intervention Groups on Change in Behaviours For Females

	Intervention Groups (n=222)			
Change in Behaviour	Letter (n=94) n (%)	Computer (n=79) n (%)	Computer & Letter (n=49) n (%)	Total n (%)
Sunscreen use				
Increase	16 (32.7)	21 (42.9)	12 (24.5)	49 (100)
No change	75 (45.2)	57 (34.3)	34 (20.5)	166 (100)
Decrease	3 (42.9)	1 (14.3)	3 (42.9)	7 (100)
Total	94	79	49	222
Wearing a hat				
Increase	7 (29.2)	9 (37.5)	8 (33.3)	24 (100)
No change	73 (43.5)	61 (36.3)	34 (20.2)	168 (100)
Decrease	13 (46.4)	8 (28.6)	7 (25.0)	28 (100)
Total	93	78	49	220
Wearing protective clothing				
Increase	14 (38.9)	14 (38.9)	8 (22.2)	36 (100)
No change	74 (42.8)	60 (34.7)	39 (22.5)	173 (100)
Decrease	4 (50.0)	2 (25.0)	2 (25.0)	8 (100)
Total	92	76	49	217
Avoid the sun				
Increase	11 (28.9)	16 (42.1)	11 (28.9)	38 (100)
No change	73 (45.3)	54 (33.5)	34 (21.1)	161 (100)
Decrease	8 (40.0)	8 (40.0)	4 (20.0)	20 (100)
Total	92	78	49	219

Note: The total number of subjects for each behaviour may not sum up to (n=222) as a result of missing observations from statistical analyses.

As with males, Mantel-Haenszel chi-square tests did not reveal any significant difference between intervention groups and behaviour change in sunscreen use, wearing a hat, wearing protective clothing, and avoiding the sun (χ^2 (1)=0.70, p=0.40, χ^2 (1)=1.22, p=0.27, χ^2 (1)=0.10, p=0.76, and χ^2 (1)=1.65, p=0.20, respectively).

Given the result that the intervention groups did not statistically differ in effectiveness, subsequent analyses combined the three intervention groups into a single intervention group.

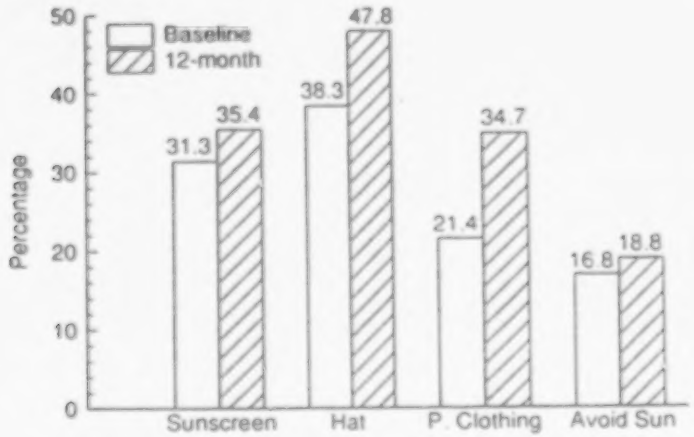
Results Pertaining to the Three Research Questions

Are Sun Protection Behaviours Likely to Change Over Time with Provision of Personalized Advice?

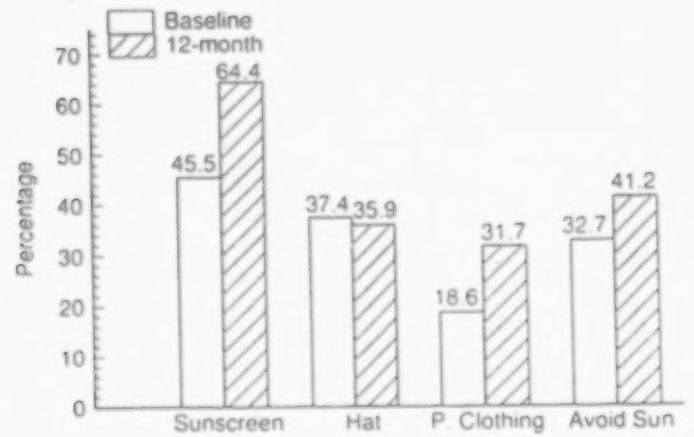
Males in the intervention group at baseline and at twelve months (Figure 3) were found to be the most frequent in the practice of wearing a hat (38.3% and 47.8%, respectively) when exposed to the sun for prolonged periods of time and least frequent in the practice of avoiding the sun (16.8% and 18.8%, respectively). On the other hand, females in the intervention group at baseline and at twelve months (Figure 3) were found to be the most frequent in the practice of sunscreen use (45.5% and 64.4%, respectively) and least frequent in the practice of wearing protective clothing (18.6% and 31.7%, respectively). The finding of a higher tendency in females to use sunscreen is consistent with the results obtained by

Figure 3

Percentage of Frequent Practice of Sun Protection Behaviours For Males At Baseline and Twelve Months in the Intervention Group (n=292)



Percentage of Frequent Practice of Sun Protection Behaviours For Females At Baseline and Twelve Months in the Intervention Group (n=222)



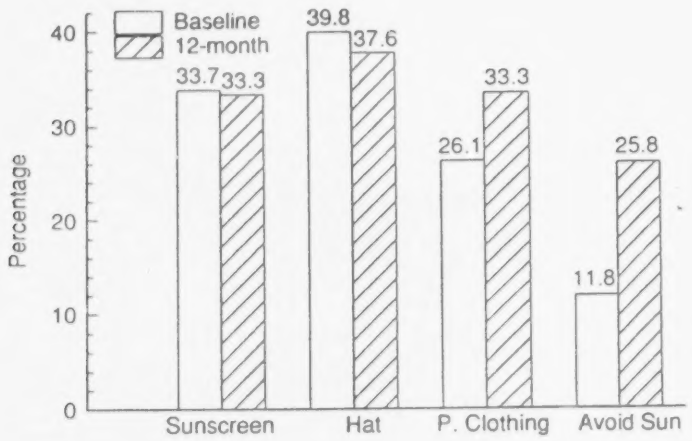
Keesling and Friedman (1987). Direct comparison between genders was possible because the proportion of frequent practice in sun protection behaviours between genders at baseline was low enough to to allow for change (Figure 3), without having to account for ceiling effects.

Parallel patterns were also observed with subjects from the control group (Figure 4). At baseline and twelve months, males were found to be most frequent in the practice of wearing a hat (39.8% and 37.6%, respectively) and least frequent in avoiding the sun (11.8% and 25.8%, respectively). For females, sunscreen use was the most frequently practiced behaviour at baseline (46.4%) and at twelve months (54.0%), and wearing protective clothing was the least frequently practiced behaviour (21.8% and 26.6%, respectively). Both the intervention and control groups were found to be comparable in their frequency of practicing all four sun protection behaviours at the baseline period. Although changes (improvement) in the practice of sun protection behaviours were seen over time, less than 50% of males and females (Figure 3) frequently practiced each of the sun protection behaviours. The one exception was sunscreen use among females (64.4%).

The results depicting an increase, stayed (no change), and decrease change in sun protection behaviours over time are presented in Figure 5, and Tables 12 and 13 (percentages in the square parentheses). Noticeable increase changes for males were found with sunscreen use (14.5%), wearing a hat (13.8%), and wearing protective clothing (18.0%). For females, the most noticeable increases were sunscreen use (22.1%), wearing of protective clothing (16.6%), and avoiding the sun (17.4%).

Figure 4

Percentage of Frequent Practice of Sun Protection Behaviours For Males At Baseline and Twelve Months in the Control Group (n=93)



Percentage of Frequent Practice of Sun Protection Behaviours For Females At Baseline and Twelve Months in the Control Group (n=126)

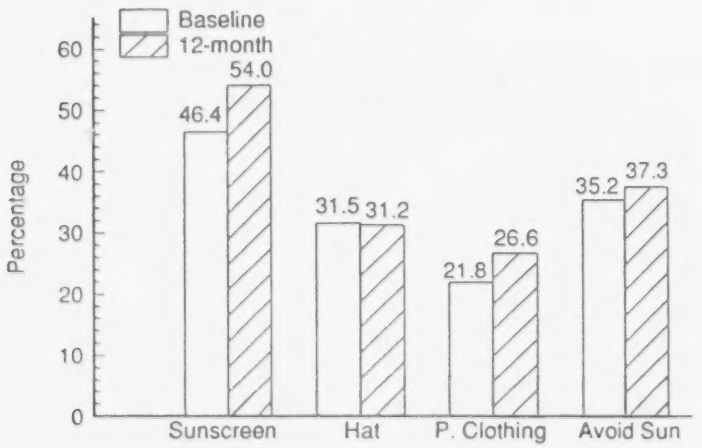
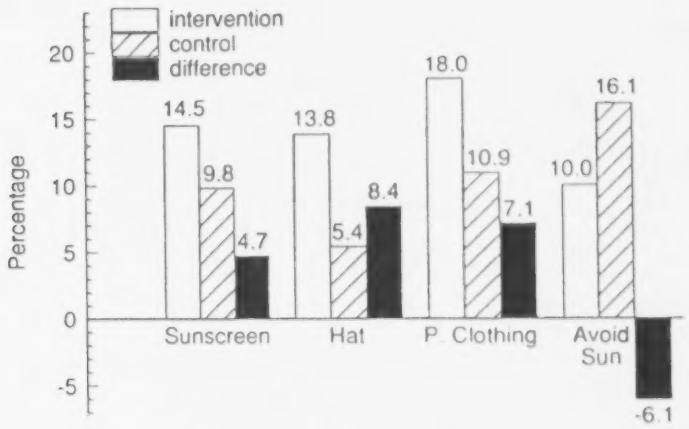
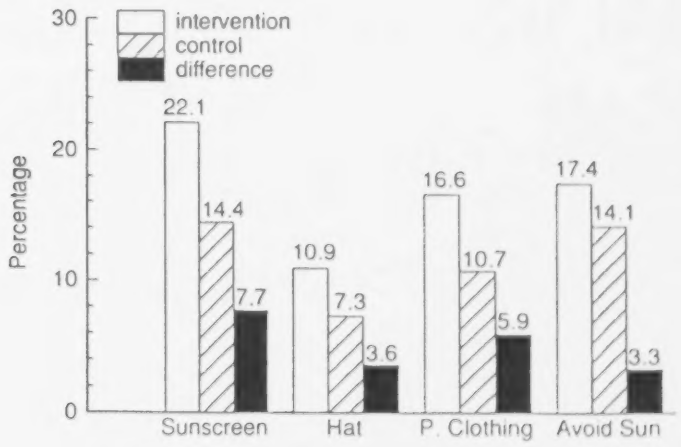


Figure 5

Percentage of Individuals Showing An Increase Change in the Practice of Sun Protection Behaviours Between Intervention and Control Groups Among Males (n=385)



Percentage of Individuals Showing An Increase Change in the Practice of Sun Protection Behaviours Between Intervention and Control Groups Among Females (n=348)



Note: Difference = reflects the differences in the percentage of increase between the intervention and control groups.

The total percentage of increase change across the four behaviours found females to have a larger increase change than males (67.0% vs 56.3%, respectively). Likewise, the control group (Tables 12 and 13) manifested an increase change across all behaviours (percentages in square parentheses). The magnitudes of change were, however, smaller than those observed with the intervention group, except for the increase change of avoiding the sun (16.1%) among males. For females, the most noticeable changes were sunscreen use (14.4%) and avoiding the sun (14.1%).

The observed changes in behaviours for the intervention and control groups were tested for significance with the use of the Mantel-Haenszel chi-square test for linear association. Cross-tabulation between these groups and changes (increase, no change, decrease) in each of the sun protection behaviours for both genders was performed. The results found the groups to differ in wearing a hat and avoiding the sun for males, and in sunscreen use for females (χ^2 (1)=5.16, p=0.02, χ^2 (1)=5.63, p=0.02, and χ^2 (1)=4.45, p=0.03, respectively). A positive pattern of change was observed with wearing a hat for males and sunscreen use for females in the intervention group; the reverse was observed with the control group. This suggests that the provision of personalized advice was effective in having males increase their frequency of wearing a hat and females in using sunscreen when exposed to prolonged sunshine. The significant change in avoiding the sun for males, however, cannot be attributed to the intervention effect because a greater level of change was found with subjects from the control group than for the intervention group.

Table 12
Percentage Change in Sun Protection Behaviours Between Groups For Males

Behaviours	Groups (n=385)		
	Intervention (n=292) n (%) [%]	Control (n=93) n (%) [%]	Total n (%)
Sunscreen Use			
Increase	42 (82.4) [14.5]	9 (17.6) [9.8]	51 (100)
No change	218 (74.7) [75.2]	74 (25.3) [80.4]	292 (100)
Decrease	30 (76.9) [10.3]	9 (23.1) [9.8]	39 (100)
Total	290 [100]	92 [100]	382
Wearing A Hat			
Increase	40 (88.9) [13.8]	5 (11.1) [5.4]	45 (100)
No change	235 (74.4) [81.3]	81 (25.6) [87.1]	316 (100)
Decrease	14 (66.7) [4.8]	7 (33.3) [7.5]	21 (100)
Total	289 [100]	93 [100]	382
Wearing Protective Clothing			
Increase	52 (83.9) [18.0]	10 (16.1) [10.9]	62 (100)
No change	223 (73.8) [77.2]	79 (26.2) [85.9]	302 (100)
Decrease	14 (82.4) [4.8]	3 (17.6) [3.3]	17 (100)
Total	289 [100]	92 [100]	381
Avoiding The Sun			
Increase	29 (65.9) [10.0]	15 (34.1) [16.1]	44 (100)
No change	239 (75.9) [82.1]	76 (24.1) [81.7]	315 (100)
Decrease	23 (92.0) [7.9]	2 (8.0) [2.2]	25 (100)
Total	291 [100]	93 [100]	384

Note: The total number of subjects for each behaviour does not sum up to (n=385) as a result of missing observations from statistical analyses.

Table 13
Percentage Change in Sun Protection Behaviours Between Groups For Females

Behaviours	Groups (n=348)		
	Intervention (n=222) n (%) [%]	Control (n=126) n (%) [%]	Total n (%)
Sunscreen Use			
Increase	49 (73.1) [22.1]	18 (26.9) [14.4]	67 (100)
No change	166 (62.6) [74.8]	99 (37.4) [79.2]	265 (100)
Decrease	7 (46.7) [3.2]	8 (53.3) [6.4]	15 (100)
Total	222 [100]	125 [100]	347
Wearing A Hat			
Increase	24 (72.7) [10.0]	9 (27.3) [7.3]	33 (100)
No change	168 (61.5) [76.4]	105 (38.5) [85.4]	273 (100)
Decrease	28 (75.7) [12.7]	9 (24.3) [7.3]	37 (100)
Total	220 [100]	123 [100]	343
Wearing Protective Clothing			
Increase	36 (73.5) [16.6]	13 (26.5) [10.7]	49 (100)
No change	173 (62.9) [79.7]	102 (37.1) [83.6]	275 (100)
Decrease	8 (53.3) [3.7]	7 (46.7) [5.7]	15 (100)
Total	217 [100]	122 [100]	339
Avoiding The Sun			
Increase	38 (67.9) [17.4]	18 (32.1) [14.4]	56 (100)
No change	161 (63.6) [73.5]	92 (36.4) [73.6]	253 (100)
Decrease	20 (57.1) [9.1]	15 (42.9) [12.0]	35 (100)
Total	219 [100]	125 [100]	344

Note: The total number of subjects for each behaviour does not sum up to (n=348) as a result of missing observations from statistical analyses.

The significant increase in the practice of wearing a hat among males and of sunscreen use among females may reflect the fact that subjects, as a result of receiving personalized advice, are more cognizant of the health benefits of adopting sun protection behaviours.

The greater frequency of males complying with the recommendation of wearing a hat when spending extended periods of time in the sun could, to some degree, be influenced by fashion in dressing. Generally, the wearing of hats has come to be more popular in Alberta and is not seen as a stereotype associated with or restricted to farmers and other working class groups. A higher compliance with sunscreen use among females, on the other hand, could be influenced by a greater concern among females with appearance. The greater use of sunscreen among females could be related to aesthetic reasons such as the desire to prevent developing wrinkles. Furthermore, a higher compliance with sunscreen use among females may be due to the fact that females are generally more comfortable with the use of cosmetics.

Notwithstanding the effects of the study intervention, it is conceivable that other extraneous variables may contribute to the increase change in behaviours observed. For example, media coverage of ozone depletion, the effects of the sun and possible cautions to take may influence the practice of sun protection behaviours among subjects in the present study. Another factor is the type of skin complexion that an individual possesses. The findings by Johnson and Lookingbill (1984) indicated that individuals who always burn and never tan or tan slightly when

exposed to prolong sunshine tended to use sunscreen and avoid the sun frequently. The finding from the present study, revealing females to have a higher overall percentage practice of sun protection behaviours than males, could be related to skin complexion and skin reaction to sun exposure. According to earlier findings, females reported that they were at least one and half times more likely than males to always or usually burn rather than tan when exposed unprotected to sunlight for prolonged periods. Thus, compliance with sun protection recommendations could be a result of a desire to avoid the unpleasant side-effects of sunburn. Examination of the role of phenotypic characteristics in influencing compliance with sun protection recommendations is suggested for future study utilizing this data set.

The resistance to increased use of sun protection behaviours may be due to psychological factors associated with sun exposure. Sun exposure is still seen as having health benefits, as pleasurable, and as socially rewarding (Cockburn et al., 1989; Marks & Hills, 1988; Robinson, 1990; Keesling & Friedman, 1987). In a region like Alberta, where the winter months are long and cold, and daylight is short, the warmth and light generated by the sun are welcomed, if not sought after. The pleasure appeal associated with sun exposure should not be underestimated. Advertising from travel agencies undoubtedly demonstrates that a big selling feature of travel is sunshine and warm weather. Related to the pleasure aspect of sun exposure are the perceived health benefits of looking healthier (Marks & Hill, 1988) and feeling good. In addition, sun exposure is socially rewarded. The value of possessing a tan is rated positively by society (Robinson, 1990; Cockburn et al., 1989;

Keesling & Friedman, 1987). The enormous influence of these psychological factors has led many to adopt sun exposure behaviours that pose an unreasonable risk to health.

The study acknowledges that there may be possible barriers to compliance with the sun protection recommendations. One potential barrier is cost. The cost of sunscreen lotions is considerable; sunscreen use may not be affordable to some, and cost may be a deterrent to others considering sunscreen use. Another barrier to sunscreen use could be the level of desired comfort. The smell and/or "sticky" sensation of sunscreen has been recognized as a deterrent in adolescents (Cockburn et al, 1989).

Do individuals who frequently practice each of the sun protection measures differ in knowledge, attitudes, and beliefs from individuals who infrequently practice these measures?

As discussed in the methods section, both the knowledge and attitudes variables use a dichotomous scale consisting of low and high categories of knowledge or attitudes. Only the low category of both these variables in relation to frequent and infrequent practice of each sun protection behaviour will be presented in the following tables. A decision was made to analyze these variables for subjects in the intervention group only, because examination of the entire sample on these variables by frequency of sun protection behaviours revealed fairly comparable patterns to those in the intervention group.

Knowledge

The results comparing levels of knowledge about skin cancer and frequency of sun protection practice for males and females separately are presented in Table 14. There were no systematic patterns revealed between levels of knowledge about skin cancer and the frequency of practicing sun protection behaviours. These results may reflect what types of knowledge regarding skin cancer were measured. For this study, knowledge regarding skin cancer was expressed in terms of how important avoiding sun exposure is in reducing the chances of developing skin cancer, how much sun exposure and family history affects the chances of developing cancer, and what are the chances of curing skin cancer if it is detected early. Knowledge regarding certain phenotypic profiles predisposing an individual to be more at risk for skin cancer, and knowledge regarding preventive measures to adopt for skin cancer, apart from avoiding the sun was, however, not assessed. It would seem that this knowledge, which was part of the personalized advice given to subjects, would influence the degree of subject's frequency in practicing sun protection. Thus, a subject may score low on the present knowledge measure but possess a high knowledge of risk factors and preventive measures regarding skin cancer.

Attitudes

The four dimensions of attitude--anxiety, denial, fatalism about prevention, and fatalism about control--are relatively independent; therefore, separate results for each of these dimensions will be presented. Discussions of both the attitudes and

Table 14
Frequent and Infrequent Practice of Sun Protection Behaviours For Low Level Knowledge by Males (n=292) and Females (n=222) in the Intervention Group

	Intervention		
	Frequent	Infrequent	p-value
LOW KNOWLEDGE (BASELINE)			
Sunscreen: Male	34/89 (38.2)	51/189 (27.0)	0.06
Female	31/92 (33.7)	45/114 (39.7)	0.39
Hat: Male	39/104 (37.5)	45/173 (26.0)	0.04
Female	30/77 (39.0)	46/129 (35.7)	0.64
Clothing: Male	21/56 (37.5)	63/221 (28.5)	0.19
Female	14/39 (35.9)	61/166 (36.7)	0.92
Avoid Sun: Male	18/45 (40.0)	67/233 (28.8)	0.13
Female	28/68 (41.2)	48/136 (35.3)	0.41
LOW KNOWLEDGE (TWELVE-MONTH)			
Sunscreen: Male	32/102 (31.4)	43/187 (23.0)	0.12
Female	58/143 (40.6)	26/76 (34.2)	0.36
Hat: Male	32/138 (23.2)	43/289 (28.5)	0.31
Female	32/79 (40.5)	51/138 (37.0)	0.60
Clothing: Male	25/101 (24.8)	50/188 (26.6)	0.73
Female	27/68 (39.7)	55/147 (37.4)	0.75
Avoid Sun: Male	15/55 (27.3)	60/235 (25.5)	0.79
Female	39/90 (43.3)	44/128 (34.4)	0.18

Note: The total number of subjects for each gender may not sum up to (males, n=292; females, n=222) as a result of missing observations from statistical analyses.

beliefs variables are presented in the last section of this question.

a) Anxiety

Overall, an inconsistent relation between levels of anxiety and frequency of sun protection practice predominates (Table 15). Furthermore, no significant difference between anxiety and practice of sun protection behaviours was found. Thus, results suggest that the degree of concern (anxiety) an individual has about potential cancer in his or her life does not appear to be related to the frequency of practicing sun protection measures.

b) Denial

The results in Table 16 suggest some association between a low level of denial and more frequent practice of sun protection behaviours. This pattern is found to be statistically significant for sunscreen use and wearing a hat for males at baseline (χ^2 (1)=4.82, p=0.03 and χ^2 (1)=4.34, p=0.04, respectively). The pattern is, however, not observed with wearing protective clothing and avoiding the sun at baseline for either gender. Further, none of the relationships are significant at twelve-month follow-up for either gender. Because the probability of obtaining statistical significance increases with the number of tests performed, the finding of two significant results out of sixteen analyses should be interpreted with caution.

c) Fatalism about prevention

Fatalism about prevention is related to the concept of self-efficacy. This implies that individuals who perceived themselves as able to perform a certain task are more likely to engage in that activity. There is generally a consistent relationship

Table 15
Frequent and Infrequent Practice of Sun Protection Behaviours For Low Level Anxiety by Males (n=292) and Females (n=222) in the Intervention Group

	Intervention		
	Frequent (%)	Infrequent (%)	p-value
LOW ANXIETY (BASELINE)			
Sunscreen: Male	52/91 (57.1)	116/198 (58.6)	0.82
Female	46/100 (46.0)	54/121 (44.6)	0.84
Hat: Male	62/110 (56.4)	105/178 (59.0)	0.66
Female	42/82 (51.2)	58/139 (41.7)	0.17
Clothing: Male	31/62 (50.0)	136/226 (60.2)	0.15
Female	17/41 (41.5)	83/179 (46.4)	0.57
Avoid Sun: Male	23/49 (46.9)	145/240 (60.4)	0.08
Female	17/41 (42.3)	83/179 (47.3)	0.48
LOW ANXIETY (TWELVE-MONTH)			
Sunscreen: Male	59/103 (57.3)	99/185 (53.5)	0.54
Female	60/142 (42.3)	34/78 (43.6)	0.85
Hat: Male	73/136 (53.7)	85/152 (55.9)	0.70
Female	37/79 (46.8)	56/139 (40.3)	0.35
Clothing: Male	50/98 (51.0)	108/190 (56.8)	0.35
Female	33/69 (47.8)	59/147 (40.1)	0.29
Avoid Sun: Male	31/55 (56.4)	128/234 (54.7)	0.82
Female	35/91 (38.5)	59/128 (46.1)	0.26

Note: The total number of subjects for each gender may not sum up (males, n=292; females, n=222) as a result of missing observations from statistical analyses.

Table 16
Frequent and Infrequent Practice of Sun Protection Behaviours For Low Level Denial by Males (n=292) and Females (n=222) in the Intervention Group

	Intervention		
	Frequent (%)	Infrequent (%)	p-value
LOW DENIAL (BASELINE)			
Sunscreen: Male	64/91 (70.3)	113/199 (56.8)	0.03
Female	62/100 (62.0)	64/120 (53.3)	0.20
Hat: Male	76/111 (68.5)	100/178 (56.2)	0.04
Female	51/82 (62.2)	75/138 (54.3)	0.26
Clothing: Male	37/62 (59.7)	139/227 (61.2)	0.82
Female	22/41 (53.7)	104/178 (58.4)	0.58
Avoid Sun: Male	28/49 (57.1)	149/241 (61.8)	0.54
Female	40/71 (56.3)	84/147 (57.1)	0.91
LOW DENIAL (TWELVE-MONTH)			
Sunscreen: Male	66/103 (64.1)	100/188 (53.2)	0.07
Female	80/141 (56.7)	43/79 (54.4)	0.74
Hat: Male	83/139 (59.7)	83/152 (54.6)	0.38
Female	47/79 (59.5)	76/139 (54.7)	0.49
Clothing: Male	62/101 (61.4)	104/190 (54.7)	0.28
Female	40/69 (58.0)	83/147 (56.5)	0.83
Avoid Sun: Male	32/55 (58.2)	135/237 (57.0)	0.87
Female	55/90 (61.1)	67/129 (51.9)	0.18

Note: The total number of subjects for each gender may not sum up (males, n=292; females, n=222) as a result of missing observations from statistical analyses.

between fatalism about prevention and frequency of practicing sun protection behaviours for both genders. Table 17 depicts an inverse relationship between a low level of fatalism (i.e., high self-efficacy) about cancer prevention and the frequent practice of sun protection behaviours for both genders, the exceptions being wearing of protective clothing for females at both time periods. The pattern observed was significant for: sunscreen use and wearing a hat for males at baseline (χ^2 (1) = 10.88, p = 0.001 and χ^2 (1) = 7.72, p = 0.005, respectively) and sunscreen use for males at twelve months (χ^2 (1) = 4.82, p = 0.03). Hence, subjects who were less fatalistic about their ability to prevent cancer were more likely to adopt sun protection frequently. These findings concurred with the literature on self-efficacy (Bandura, 1977; 1986), which suggests that an individual's perceived ability for a given task will mediate future attempts to engage in that task. Furthermore, perception of self-efficacy will greatly influence, among other things, effort expenditure and choices in performing a task.

d) Fatalism about control

Similarly, a consistent relationship between fatalism about control and sun protection practice was observed for both genders (Table 18). A low level of fatalism was associated with frequent practice of sun protection behaviours except for avoiding the sun among males at baseline. Statistical significance supporting the overall trend was established for: sunscreen use for males at baseline and twelve months (χ^2 (1) = 9.04, p = 0.003, χ^2 (1) = 4.52, p = 0.03, respectively), wearing of

Table 17
Frequent and Infrequent Practice of Sun Protection Behaviours For Low Level Fatalism About Prevention by Males (n=292) and Females (n=222) in the Intervention Group

	Intervention		
	Frequent (%)	Infrequent (%)	p-value
LOW FATALISM ABOUT PREVENTION (BASELINE)			
Sunscreen: Male	70/91 (76.9)	113/199 (56.8)	0.001
Female	68/100 (68.0)	74/118 (62.7)	0.41
Hat: Male	81/111 (73.0)	101/178 (56.7)	0.005
Female	54/80 (67.5)	88/138 (63.8)	0.58
Clothing: Male	40/62 (64.5)	142/227 (62.6)	0.78
Female	26/41 (63.4)	115/176 (65.3)	0.82
Avoid Sun: Male	33/49 (67.3)	150/241 (62.2)	0.50
Female	51/70 (72.9)	89/146 (61.0)	0.09
LOW FATALISM ABOUT PREVENTION (TWELVE-MONTH)			
Sunscreen: Male	81/101 (80.2)	128/188 (68.1)	0.03
Female	88/142 (62.0)	47/79 (59.5)	0.72
Hat: Male	102/138 (73.9)	107/151 (70.9)	0.56
Female	49/78 (62.8)	85/141 (60.3)	0.71
Clothing: Male	75/100 (75.0)	134/189 (70.9)	0.46
Female	40/69 (58.0)	94/148 (63.5)	0.43
Avoid Sun: Male	40/55 (72.7)	170/235 (72.3)	0.95
Female	62/91 (68.1)	72/129 (55.8)	0.07

Note: The total number of subjects for each gender may not sum up (males, n=292; females, n=222) as a result of missing observations from statistical analyses.

Table 18
Frequent and Infrequent Practice of Sun Protection Behaviours For Low Level Fatalism About Control by Males (n=292) and Females (n=222) in the Intervention Group

		Intervention		
		Frequent (%)	Infrequent (%)	p-value
LOW FATALISM ABOUT CONTROL (BASELINE)				
Sunscreen:	Male	61/90 (67.8)	96/197 (48.7)	0.003
	Female	64/100 (64.0)	66/120 (55.0)	0.18
Hat:	Male	64/111 (57.7)	93/175 (53.1)	0.45
	Female	56/82 (68.3)	74/138 (53.6)	0.03
Clothing:	Male	34/61 (55.7)	123/225 (54.7)	0.88
	Female	27/41 (65.9)	102/178 (57.3)	0.32
Avoid:	Male	24/48 (50.0)	133/239 (55.6)	0.47
	Female	45/70 (64.3)	85/148 (57.4)	0.34
LOW FATALISM ABOUT CONTROL (TWELVE-MONTH)				
Sunscreen:	Male	70/103 (68.0)	102/185 (55.1)	0.03
	Female	94/140 (67.1)	49/78 (62.8)	0.52
Hat:	Male	88/137 (64.2)	84/151 (55.6)	0.14
	Female	51/76 (67.1)	91/140 (65.0)	0.76
Clothing:	Male	68/100 (68.0)	104/188 (55.3)	0.04
	Female	45/68 (66.2)	97/146 (66.4)	0.97
Avoid Sun:	Male	35/55 (63.6)	138/234 (59.0)	0.53
	Female	66/89 (74.2)	76/128 (59.4)	0.02

Note: The total number of subjects for each gender may not sum up (males, n=292; females, n=222) as a result of missing observations from statistical analyses.

protective clothing for males at twelve months (χ^2 (1)=4.36, p=0.04), wearing a hat for females at baseline (χ^2 (1)=4.58, p=0.03), and avoiding the sun for females at twelve months (χ^2 (1)=5.07, p=0.02). These results suggest that individuals who are less fatalistic about their abilities to control for potential cancer in their lives are more likely to engage in sun protection behaviours. These results are supported by the literature on the role of perceived control of self-efficacy in facilitating action on a task. Like those individuals with low fatalism about prevention of cancer, individuals with a high level of perceived self-efficacy for controlling cancer in their lives (i.e., low fatalism about control) are more likely to practice sun protection.

Beliefs

Examination of the relationship between belief in the likelihood of developing cancer and the frequency of practicing sun protection behaviours revealed no systematic relationships (Tables 19 for baseline and 20 for twelve-month). None of the relationships observed were statistically significant.

Factors Influencing Knowledge, Attitudes, and Beliefs

The relationships between the knowledge, attitudes and beliefs variables and the frequency of practicing sun protection behaviours, whether consistent or not, were potentially subject to a number of influences. Interpretation of results should take these factors into consideration.

The first factor concerns the information obtained from the questionnaires.

Table 19
Frequent and Infrequent Practice of Behaviours by Beliefs Concerning Likelihood of Developing Cancer For the Intervention Group At Baseline

	Intervention (n=514)					
	Male (n=292)			Female (n=222)		
	Frequent n (%)	Infrequent n (%)	p-value	Frequent n (%)	Infrequent n (%)	p-value
Sunscreen Use						
Unlikely	39 (43.3)	74 (37.9)	0.33	32 (32.7)	31 (25.8)	0.38
50/50	42 (46.7)	108 (55.4)		53 (54.1)	76 (63.3)	
Likely	9 (10.0)	13 (6.7)		13 (13.3)	13 (10.8)	
Total	90	195		98	120	
Wearing A Hat						
Unlikely	43 (40.2)	69 (39.0)	0.91	26 (32.5)	37 (26.8)	0.67
50/50	55 (51.4)	95 (53.7)		45 (56.3)	84 (60.9)	
Likely	9 (8.4)	13 (7.3)		9 (11.3)	17 (12.3)	
Total	107	177		80	138	
Wearing Protective Clothing						
Unlikely	26 (43.3)	86 (38.4)	0.51	11 (26.8)	52 (29.5)	0.26
50/50	28 (46.7)	122 (54.5)		22 (53.7)	106(60.2)	
Likely	6 (10.0)	16 (7.1)		8 (19.5)	18 (10.2)	
Total	60	224		41	176	
Avoiding The Sun						
Unlikely	21 (43.8)	92 (38.8)	0.77	16 (22.5)	46 (31.7)	0.23
50/50	23 (47.9)	127 (53.6)		44 (62.0)	85 (58.6)	
Likely	4 (8.3)	18 (7.6)		11 (15.5)	14 (9.7)	
Total	48	237		71	145	

Note: 1) Totals for each gender may not sum up to original n size due to missing observations from analyses. 2) 50/50 = even chance

Table 20
Frequent and Infrequent Practice of Behaviours by Beliefs Concerning The Likelihood of Developing Cancer For The Intervention Group At Twelve Months

	Intervention (n=514)					
	Male (n=292)			Female (n=222)		
	Frequent n (%)	Infrequent n (%)	p-value	Frequent n (%)	Infrequent n (%)	p-value
Sunscreen Use						
Unlikely	41 (39.8)	67 (35.6)	0.48	41 (28.7)	20 (25.3)	0.82
50/50	52 (50.5)	105(55.9)		85 (59.4)	48 (60.8)	
Likely	9 (8.7)	16 (8.5)		17 (11.9)	11 (13.9)	
Total	102	188		143	79	
Wearing A Hat						
Unlikely	53 (38.1)	55 (36.2)	0.74	35 (31.6)	35 (24.8)	0.51
50/50	73 (52.5)	84 (55.3)		44 (55.7)	89 (63.1)	
Likely	12 (8.6)	13 (8.6)		10 (12.7)	17 (12.1)	
Total	138	152		79	141	
Wearing Protective Clothing						
Unlikely	41 (40.6)	67 (35.3)	0.38	17 (24.6)	42 (28.2)	0.86
50/50	52 (51.5)	105(55.3)		43 (62.3)	89 (59.7)	
Likely	7 (6.9)	18 (9.5)		9 (13.0)	18 (12.1)	
Total	100	190		69	149	
Avoiding The Sun						
Unlikely	22 (40.0)	87 (36.7)	0.50	24 (26.4)	37 (28.5)	0.90
50/50	31 (56.4)	126(53.2)		56 (61.5)	76 (58.5)	
Likely	2 (3.6)	23 (9.7)		11 (12.1)	17 (13.1)	
Total	55	236		91	130	

Note: 1) Totals for each gender may not sum up to original n size due to missing observations from analyses. 2) 50/50 = even chance

The questions used by the "Cancer Prevention In The Workplace" study were intended to gather information related to cancer over multiple sites. The attitudes and belief questions, therefore, were worded so as to relate these variables to cancer in general. The lack of specificity in relating these attitudes and beliefs questions to skin cancer may have influenced some of the results. The lack of specific beliefs and attitudes may account for the lack of significant relationships to specific behaviour (relevant to a specific type of cancer). The variation between subjects due to their perception of the types of cancer involved could explain the patterns seen in the results.

Second, the lack of consistent patterns observed could be a result of collapsing some of the variables' scales to a dichotomous scale. Collapsing the data reduces the sensitivity of the scale. A narrower variable scale restricts the range of responses to choose from, and, as a result, loses information. Furthermore, collapsing the data potentially produces a neutralizing effect on responses. For example, if the number of subjects who responded that they scored high on a particular attitude are approximately equal to those who responded that they scored low, the overall pattern would likely reflect subjects as having a moderate score on that attitude. Hence, these effects reduce the probability of detecting an association between variables and weaken any statistical effects.

Finally, the knowledge, attitudes and beliefs that individuals have or adhere to may have little bearing on actual behaviours because of psychological factors that are associated with exposure to the sun. Some literature does suggest that attitudes

and intentions are not related to actual practice of sun protection behaviours (Hill, Rassaby & Gardner, 1984). As previously mentioned, these psychological factors may well defy reasoning in determining behaviour. Thus, an individual may have good knowledge about skin cancer, believe that he/she is likely to get cancer some time in his/her lifetime, be concerned about skin cancer, not be fatalistic about prevention and control, and not engage in denial, but still be infrequent in the practice of sun protection behaviours.

What Proportion of Subjects in the Intervention and Control Groups Progress From One Stage to Another with the Provision of Personalized Advice?

The distribution of males and females across each stage of change at baseline and twelve months is shown in Table 21. The majority of males from the intervention group at baseline were classified in the precontemplation (n=109, 39.6%) and maintenance (n=109, 39.6%) stages. At twelve months, the majority of males were found to be in the precontemplation (n=126, 44.5%) and contemplation (n=96, 33.9) stages. On the other hand, the majority of females from the intervention group at baseline were found to be in the contemplation (n=69, 33.0%) and maintenance (n=75, 35.9%) stages. At twelve months, the majority of the females, like the males, were found to be in the precontemplation (n=62, 28.8%) and contemplation (n=86, 40.0%) stages. The action stage had the smallest number of subjects at both time periods for both genders. The proportions, thus far reported, are contaminated by a number of errors in subjects' self-reporting, which may be due

Table 21
Stages of Change at Baseline and Twelve-Month Period for the Intervention Group

	Baseline		Twelve-Month	
	Male (n=292)	Female (n=222)	Male (n=292)	Female (n=222)
Stages of change				
Precontemplation	109 (39.6)	56 (26.8)	126 (44.5)	62 (28.8)
Contemplation	53 (19.3)	69 (33.0)	96 (33.9)	86 (40.0)
Action	4 (1.5)	9 (4.3)	15 (5.3)	21 (9.8)
Maintenance	109 (39.6)	75 (35.9)	46 (16.3)	46 (21.4)
Total	275 (100%)	209 (100%)	283 (100%)	215 (100)

Note: 1) The total number of subjects for each gender does not sum up to (males, n=292; females, n=222) as a result of missing observations from statistical analyses.

to the problem of recall. A small number of subjects in the precontemplation and contemplation stages reported that they had progressed to the maintenance stage, which is not possible under the present staging algorithm. This self-report error is adjusted by excluding these subjects when considering subjects' movement between stages. The problems of recall bias and limitations in the staging algorithm were discussed in the section "Limitations of the Study" (Chapter I, p. 7).

The results of the overall direction of movement between stages of change over time is presented in Table 22 (percentages in square brackets). Slightly less than half of the subjects (49.2%) from the intervention group were found to move from one stage of change to another. Ironically, of the proportion that showed

movement between stages, most of the subjects moved backwards (32.1%). Only 17.1% of the subjects advanced to a higher stage of change. Gender differentiation showed females to have a higher percentage of advancement in the stages of change than males (21.0% vs 14.2%). On the other hand, the overall control group was found to have a lower proportion of subjects advancing to a higher stage of change (9.0%) than the intervention group. Gender specific control groups also displayed a higher proportion of subjects (35.7% for males, 36.5% for females) regressing to initial stages of change over time than subjects in the intervention group (31.5% for males, 32.8% for females).

Mantel-Haenszel chi-square tests for linear association performed between groups (intervention and control) and direction of movement (Table 22) found the two groups to be significantly different in their pattern of movement (χ^2 (1)=4.61, p=0.03). As depicted in table 22 (percentages in ( ) parentheses), the overall intervention group showed a forward movement in the stages of change. A reverse pattern was observed for the overall sample control group. Thus, it can be concluded that the subjects in the intervention group were significantly more likely to adopt or intend to adopt sun protection behaviours. Hence, personalized advice did facilitate adoption or maintenance of sun protection measures. This is consistent with earlier findings of an increase change in the practice of sun protection behaviour.

As indicated earlier, both forward (progressive) and backward (regressive) movements between the stages of change were observed. Emerging from these movements were a number of patterns in the overall sample group (Table 23) and

Table 22
Direction of Movement Between Stages of Behaviour Change Over Time

	Direction of Change				Statistical Values		
Groups	Forw. n (%)	Stay. n (%)	Back. n (%)	Total n (%)	df	χ^2	p-value
Intervention [n=514]	78 (81.3) [17.1]	231 (67.9) [50.8]	146 (67.0) [32.1]	455 [100]			
Control [n=219]	18 (18.8) [9.0]	109 (32.1) [54.8]	72 (33.0) [36.2]	199 [100]	1	4.61	0.03
Total	96 (100)	340 (100)	218 (100)	654			
Male (Intervention) [n=292]	37 (84.1) [14.2]	141 (75.0) [54.2]	82 (73.2) [31.5]	260 [100]			
Male (Control) [n=93]	7 (15.9) [8.3]	47 (25.0) [56.0]	30 (26.8) [35.7]	84 [100]	1	1.55	0.21
Total	44 (100)	188 (100)	112 (100)	344			
Female (Intervention) [n=222]	41 (78.8) [21.0]	90 (59.2) [46.2]	64 (60.4) [32.8]	195 [100]			
Female (Control) [n=126]	11 (21.2) [9.6]	62 (40.8) [53.9]	42 (39.6) [36.5]	115 [100]	1	3.46	0.06
Total	52 (100)	152 (100)	106 (100)	310			

Note: 1) Total number of subjects for each pair of groups does not sum up to the original n size as a result of missing observations from statistical analyses and adjustment for subjects' self-report errors.
2) Stay. = Stayed, Forw. = Forward, Back. = Backward
3) Row and Column percentages are presented in ( ) and [ ], respectively.

in gender-specific groups (Tables 24 and 25).

Patterns of forward movement within the stages of change revealed a high percentage of advance from the precontemplation stage to the contemplation stage. This suggests a positive change in subjects' sun protection behaviours. Although the majority of this movement was to the contemplation stage, which lacks any outward manifestation of behaviour change, this advancement in stage is encouraging because it indicates that a greater number of subjects have progressed from being unaware and/or unwilling to increase their practice of sun protection behaviours to considering adopting sun protection measures. Furthermore, this pattern is consistent with findings from earlier studies on stages of change, which found adjacent stages to correlate more highly with each other than with any other stage, thus suggesting a predictable movement through the stages of change (McConnaught et al., 1983).

The progress seen with subjects from the precontemplation stage, however, does not concur with suggestions from the literature indicating that precontemplators are generally the most difficult group to motivate to behaviour change. Typically, before an individual takes action to modify a behaviour, some developmental processes (moving into a new stage in life) have occurred and/or the individual's environment has changed substantially (Prochaska & DiClemente, 1982). One explanation for the magnitude of this atypical pattern could be the large variation in the number of subjects in each stage. For example, the action stage had a very small number of subjects in comparison to the precontemplation stage. Hence, in the overall comparison, it is likely for subjects in the action stage to show a smaller

Table 23
Movement Between Stages Of Change Over Time For The Intervention and Control Groups

	Stages of Behaviour Change (At Twelve Months)				
	Precon. n (%)	Contem. n (%)	Action n (%)	Maint. n (%)	Total n (%)
Intervention Group (n=514) (At Baseline)					
Precon.	89 (58.2)	59 (38.6)	5 (3.3)	0	153 (100)
Contem.	30 (26.3)	74 (64.9)	10 (8.8)	0	114 (100)
Action	4 (33.3)	4 (33.3)	0	4 (33.3)	12 (100)
Maint.	54 (30.7)	34 (19.3)	20 (11.4)	68 (38.6)	176 (100)
Total	177	171	35	72	455
Control Group (n=219) (At Baseline)					
Precon.	40 (74.1)	14 (25.9)	0	0	54 (100)
Contem.	13 (25.5)	37 (72.5)	1 (2.0)	0	51 (100)
Action	1 (14.3)	2 (28.6)	1 (14.3)	3 (42.9)	7 (100)
Maint.	37 (42.5)	17 (19.5)	2 (2.3)	31 (35.6)	87 (100)
Total	91	70	4	34	199

Note: 1) The total number of subjects for each group does not sum up to (n=514 and n=219) as a result of missing observations from statistical analyses and adjustment for subjects' self-report errors.
2) Precon. = Precontemplation, Contem. = Contemplation, Maint. = Maintenance.

Table 24
Movement Between Stages Of Change Over Time For Males In The Intervention and Control Groups

	Stages of Behaviour Change (At Twelve Months)				
	Precon. n (%)	Contem. n (%)	Action n (%)	Maint. n (%)	Total n (%)
Intervention Group (n=292) (At Baseline)					
Precon.	67 (65.0)	34 (33.0)	2 (1.9)	0	103 (100)
Contem.	12 (24.5)	37 (75.5)	0	0	49 (100)
Action	1 (33.3)	1 (33.3)	0	1 (33.3)	3 (100)
Maint.	39 (37.1)	16 (15.2)	13 (12.4)	37 (35.2)	105 (100)
Total	119	88	15	38	260
Control Group (n=93) (At Baseline)					
Precon.	19 (76.0)	6 (24.0)	0	0	25 (100)
Contem.	6 (26.1)	16 (69.6)	1 (4.3)	0	23 (100)
Action	1 (100)	0	0	0	1 (100)
Maint.	14 (40.0)	8 (22.9)	1 (2.9)	12 (34.3)	35 (100)
Total	40	30	2	12	84

Note: 1) The total number of subjects for each group does not sum up to (n=292 and n=93) as a result of missing observations from statistical analyses and adjustment for subjects' self-report errors.
2) Precon. = Precontemplation, Contem. = Contemplation, Maint. = Maintenance.

Table 25
Movement Between Stages Of Change Over Time For Females In The Intervention and Control Groups

	Stages of Behaviour Change (At Twelve Months)				
	Precon. n (%)	Contem. n (%)	Action n (%)	Maint. n (%)	Total n (%)
Intervention Group (n=222) (At Baseline)					
Precon.	22 (44.0)	25 (50.0)	3 (6.0)	0	50 (100)
Contem.	18 (27.7)	37 (56.9)	10 (15.4)	0	65 (100)
Action	3 (33.3)	3 (33.3)	0	3 (33.3)	9 (100)
Maint.	15 (21.1)	18 (25.4)	7 (9.9)	31 (43.7)	71 (100)
Total	58	83	20	34	202
Control Group (n=126) (At Baseline)					
Precon.	21 (72.4)	8 (27.6)	0	0	29 (100)
Contem.	7 (25.0)	21 (75.0)	0	0	28 (100)
Action	0	2 (33.3)	1 (16.7)	3 (50.0)	6 (100)
Maint.	23 (44.2)	9 (17.3)	1 (1.9)	19 (36.5)	52 (100)
Total	51	40	2	23	115 (100)

Note: 1) The total number of subjects for each group do not sum up to (n=222 and n=126) as a result of missing observations from statistical analyses and adjustment for subjects' self-report errors.
2) Precon. = Precontemplation, Contem. = Contemplation, Maint. = Maintenance.

percentage of subjects progressing in the stages of change than the precontemplation stage. Although the inclination to attribute this phenomenon to the effectiveness of the intervention should not be dismissed, caution needs to be exercised in light of findings from earlier literature.

Patterns of backward movement were also seen in both gender groups. Two patterns, in particular, were observed: 1) a large number of the subjects regressed from the contemplation stage to the precontemplation stage, and 2) a large number of subjects regressed from the maintenance stage to the precontemplation and contemplation stages.

The first pattern, although consistent with earlier findings regarding movement between adjacent stages as being most pronounced (McConnaught et al., 1983), is somewhat puzzling. According to the literature (Prochaska & DiClemente, 1983; Ahijevych & Wewers, 1992), consciousness raising was used more by contemplators than by precontemplators, precontemplators being less active than contemplators in gathering and/or processing information related to modification of a target behaviour. The intervention, personalized advice, in the present study, resembles consciousness raising. This being the case, it would seem that, if the intervention were effective, the contemplation rather than the precontemplation stage should depict more of an advance in the stages of change over time. The results, however, display an opposite pattern.

The potential problem of misclassifying subjects due to the staging algorithm could perhaps shed some light on this pattern. For example, a subject in the

contemplation stage may decide, upon receiving the intervention, to add on to his/her current practice of sunscreen use the behaviour of wearing a hat. During the completion of the twelve-month follow-up questionnaire, he/she would appropriately respond "no" to the question regarding whether or not he/she is currently practicing all three sun protection behaviours. Furthermore, it is conceivable that this subject may decide not to further increase other sun protection measures. As such, he/she would respond "no" to the question inquiring whether or not he/she is seriously considering using increased sun protection. Under the present staging algorithm, this subject would be classified as a precontemplator. The algorithm is unable to account for subjects who practice less than three of the specified sun protection measures or who maintain practice of one or two sun protection measures. This misclassification would mask the indication of advance in the stages of change for certain sun protection behaviours. Thus, this imprecision in the classification of subjects is a probable explanation for apparent regression to the precontemplation stage.

The second pattern demonstrating a backward movement runs contrary to expected movement between stages of change. Given that adjacent stages are more correlated (McConnaught et al., 1983), a regressing subject who practices sunscreen use, wearing a hat, and wearing protective clothing would be expected to move to the action or contemplation stage rather than to the precontemplation stage. The unusual trend actually observed could again be due to potential misclassification of subjects.

Consider a subject who was classified as one who practices all three of the sun

protection behaviours (maintenance stage). Over the one year period, he/she might cease to practice wearing a hat. On the twelve-month follow-up questionnaire the subject would appropriately respond "no" to the question regarding whether or not he/she is currently always practicing all three sun protection measures. A subsequent staging question asking whether or not he/she is seriously considering increasing sun protection could be answered "no". According to the staging algorithm, this subject will be classified as a precontemplator.

In summary, the results suggest that personalized advice is effective in encouraging individuals to seriously consider adopting sun protection measures or to increase their practice of sun protection measures. This conclusion is based on findings showing the intervention group to have a higher percentage of subjects advancing through the stages of change than does the control group. In addition, the potential phenomenon of misclassifying subjects further increases the probability of underestimating the effects of the intervention, by not accounting for subjects who may have shown an increased intention to practice or who may be practicing one or two of the sun protection measures.

Cross-Validation of Subjects' Self-Reports

In addition to addressing the research question, an attempt to cross-validate subjects' self-reports of behaviour change was also carried out. The reported frequency of practicing sun protection behaviours was correlated with the stages of behaviour change score. It would be expected that subjects who were frequent in

practicing sun protection measures would more likely be found in the action or maintenance stages. As depicted in tables 26 (males) and 27 (females), there was a positive association between the two measures. Those reporting that they frequently practiced the different sun protection measures were more likely to be in the maintenance behaviour change category than in the low categories. There were inconsistencies, however, in that some of those in the initial stages of behaviour change also reported frequent use of the sun protective practices. This may be due to the previously discussed misclassification problem for the staging algorithm or due to inconsistencies in subjects' self-reports.

Table 26
Frequency Comparisons Between Frequent and Infrequent Practice of Sun Protection Behaviours and Stages of Behaviour Change For Males

	Intervention Group (n=292)				
	Stages of Change				
Behaviours	Precon.	Contem.	Action	Maint.	Total
BASELINE					
Sunscreen Use					
Frequent (Infrequent)	8 (101)	11 (42)	2 (2)	67 (42)	88 (187)
Wearing A Hat					
Frequent (Infrequent)	22 (87)	18 (35)	1 (3)	64 (44)	105 (169)
Wearing Protective Clothing					
Frequent (Infrequent)	9 (100)	3 (50)	2 (2)	45 (63)	59 (215)
Avoiding The Sun					
Frequent (Infrequent)	7 (102)	3 (50)	2 (2)	34 (75)	46 (229)
TWELVE-MONTH					
Sunscreen Use					
Frequent (Infrequent)	35 (90)	23 (73)	8 (7)	31 (15)	97 (185)
Wearing A Hat					
Frequent (Infrequent)	46 (79)	41 (55)	9 (6)	37 (9)	133 (149)
Wearing Protective Clothing					
Frequent (Infrequent)	29 (96)	18 (78)	10 (5)	39 (7)	96 (186)
Avoiding The Sun					
Frequent (Infrequent)	15(111)	17 (79)	4 (11)	16 (30)	52 (231)

Note: 1) The total number of subjects for each behaviour does not sum up to (n=292) as a result of missing observations from statistical analyses.
2) Precon. = Precontemplation, Contem. = Contemplation, Maint. = Maintenance

Table 27
Frequency Comparisons Between Frequent and Infrequent Practice of Sun Protection Behaviours and Stages of Behaviour Change For Females

	Intervention Group (n=222)				
	Stages of Change				
Behaviours	Precon.	Contem.	Action	Maint.	Total
BASELINE					
Sunscreen Use					
Frequent (Infrequent)	12 (44)	26 (43)	5 (4)	52 (23)	95 (114)
Wearing A Hat					
Frequent (Infrequent)	13 (43)	16 (53)	3 (6)	45 (30)	77 (132)
Wearing Protective Clothing					
Frequent (Infrequent)	1 (55)	4 (64)	2 (7)	29 (46)	36 (172)
Avoiding The Sun					
Frequent (Infrequent)	7 (49)	15 (53)	3 (6)	39 (35)	64 (143)
TWELVE-MONTH PERIOD					
Sunscreen Use					
Frequent (Infrequent)	34 (28)	50 (36)	16 (5)	41 (5)	141 (74)
Wearing A Hat					
Frequent (Infrequent)	15 (47)	25 (60)	7 (13)	29 (17)	76 (137)
Wearing Protective Clothing					
Frequent (Infrequent)	13 (48)	16 (69)	9 (10)	28 (18)	66 (145)
Avoiding The Sun					
Frequent (Infrequent)	15 (47)	29 (57)	9 (12)	35 (10)	88 (126)

Note: 1) The total number of subjects for each behaviour does not sum up to (n=222) as a result of missing observations from statistical analyses.
2) Precon. = Precontemplation, Contem. = Contemplation, Maint. = Maintenance

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents a brief summary of the objectives, methods, findings, and conclusions of this study. In addition, implications of the study's findings, a number of caveats, and recommendations for future research are addressed.

Study Objectives

The objectives of this study were:

1) To investigate whether or not personalized advice will facilitate a change in sun protection behaviours over time by examining overt change in sun protection behaviours and by examining movement between stages of behaviour change, and

2) To investigate whether knowledge, attitudes, and beliefs differ between individuals who frequently and infrequently practice sun protection measures.

Methods

Self-reported data from the Alberta Cancer Board's study project, "Cancer Prevention in the Workplace", were utilized. The study design, therefore, was adopted from the Alberta Cancer Board's project. Corporations that met the study requirements in terms of having multiple departments (each between 100 and 300

subjects) with similar gender, age and education distribution, and ability and willingness to administer the study intervention, were eligible to participate in the study. The intervention, personalized skin cancer prevention advice, was delivered through either letter, computer, or computer and letter after the baseline data were collected. Data were obtained through questionnaires collected at the beginning of the study, after six months, and at the twelve-month follow-up period. A control group received no intervention until the twelve-month data were collected. A one-stage cluster sampling design was used to randomly assign each department within a corporation to one of the three intervention groups or to the control group. This was done primarily for logistical reasons and to prevent contamination of the study intervention modalities. The effectiveness of the study intervention in engendering positive behaviour change was determined by examining overt changes, over twelve months, in sun protection behaviours: 1) sunscreen use, 2) wearing a hat, 3) wearing protective clothing, and 4) avoiding the sun between 10 a.m. and 3 p.m.

The Transtheoretical Model of stages of behaviour change (Prochaska & DiClemente, 1992) was also used to examine both overt (behavioural) and covert (intentional) change in sun protection behaviours over time. Four questions related to the stages of behaviour change staging algorithm were used at baseline and at twelve months to classify subjects into one of five stages of change. Subjects were assigned to one of five stages based on their responses to these questions: "Do you currently use sun protection (wearing sunscreen, wearing a hat, and wearing long sleeves and pants) when exposed to sunlight for extended periods?"; "How long ago

did you change (increase) your sun protection practices?"; "Are you seriously considering using increased sun protection?"; and "When do you plan on increasing your sun protection practices?". The present study's operational definitions of these stages are as follows:

"Precontemplation stage" - no serious consideration to increase protection from the sun;

"Contemplation stage" - the intention to increase sun protection in six months;

"Preparation stage" - the intention to increase sun protection immediately or in the next 30 days;

"Action stage" - the adoption of sun protection practices for less than twelve months; and

"Maintenance stage" - the adoption of sun protection practices for over a year.

Due to low numbers in the preparation stage, the preparation stage was combined with the contemplation stage and named "contemplation stage".

The availability of data resulted in the present study's utilizing only the baseline and twelve-month data. A decision was made to collapse the three intervention groups into a single intervention group. This initiative was taken after comparisons between the effectiveness of each of the intervention modes failed to reveal any statistically significant difference. Of the 885 corporate workers from two corporations from the City of Calgary, only 733 subjects (385 males and 348 females) were used in the study. The 146 subjects who failed to complete all the

questionnaires were excluded from the study. Cross-tabulations and Mantel-Haenszel chi-square tests for linear association and Goodness of Fit tests were performed in addressing all research questions.

Summary of Findings

The intervention and control groups were comparable in their frequency of practicing all four sun protection behaviours at the baseline period. For the intervention group at baseline and at twelve months, wearing a hat was found to be the most frequent protection behaviour practiced among males (38.3% and 47.8%, respectively), while sunscreen use was found to be the most frequently practiced protection behaviour among females (45.5% and 64.4%, respectively). Parallel patterns were also observed in subjects from the control group. Despite the continuing trend, in the majority of the males and females, of practicing most of the sun protection measures infrequently, a positive change toward adopting a greater practice of sun protection measures was observed. Across the four behaviours (sunscreen use, wearing a hat, wearing protective clothing, and avoiding the sun), females demonstrated a larger increase change than males (67.0% vs 56.3%, respectively). This finding could be related to skin complexion and skin reaction to sun exposure. According to earlier findings, females reported that they were at least one and half times more likely than males to always or usually burn rather than tan when exposed unprotected to sunlight for prolonged periods. Thus, compliance with sun protection recommendations could be a result of a desire to avoid the unpleasant

side-effects of sunburn. Noticeable increase changes in sunscreen use (14.5%), wearing a hat (13.8%), and wearing protective clothing (18.0%) were found among males. On the other hand, increase changes in sunscreen use (22.1%), wearing protective clothing (16.6%), and avoiding the sun (17.4%) were most noticeable among females. Among these increase changes, the wearing of a hat for males and sunscreen use for females were found to be statistically significant. This indicates that the provision of personalized advice appears to be effective in motivating males to increase their frequency of wearing a hat and in motivating females to increase their frequency in using sunscreen when exposed to prolonged sunshine.

Differences in attitudes of fatalism about prevention and fatalism about control of cancer were found between individuals who frequently and infrequently practiced sun protection measures. Individuals who frequently practiced sun protection measures were found to have a lower level of fatalism about prevention and control of cancer. Thus, individuals who were less fatalistic about their ability to prevent and control potential cancer were found to practice sun protection measures frequently. No other systematic relationships were established between the frequency of practicing sun protection behaviours and knowledge of skin cancer, attitudes of anxiety or denial, or beliefs about the likelihood of developing cancer.

A micro-analytical examination of the movements between stages of change revealed that a majority of the subjects: a) from the precontemplation stage moved to the contemplation stage, b) from the contemplation stage slipped back to the precontemplation, and c) from the maintenance stage slipped back to the

precontemplation or contemplation stages. In exploring changes in sun protection behaviours using the Transtheoretical Model, the study revealed that 49.2% of the subjects from the intervention groups showed movement between stages of change. Only 17.1% of these subjects, however, moved forward while a greater percentage of the subjects (32.1%) moved backward. Nevertheless, progress is evident, since the proportion of subjects from the intervention group who advanced to a higher stage of change was higher than that in the control group. Gender differences were also noted, with females demonstrating a higher percentage of advance in the stages of change than males (21.0% vs. 14.2%). On the other hand, the overall control group was found to have a lower proportion of subjects advancing to a higher stage of change (9.0%). Gender specific control groups also displayed a higher proportion of subjects (35.7% for males, 36.5% for females) regressing to initial stages of change over time than subjects in the intervention group (31.5% for males, 32.8% for females). Mantel-Haenszel chi-square tests for linear association performed between the intervention and control groups and the direction of movements found the two groups to be significantly different in their pattern of movement (χ^2 (1)=4.61, p=.03). The overall intervention group showed a greater forward movement in the stages of change than did the control group. Thus, it was concluded that the subjects in the intervention group were significantly more likely to adopt or intend to adopt sun protection behaviours. Personalized advice therefore did facilitate adoption or maintenance of sun protection measures. This is consistent with earlier findings of an increase change in the practice of sun protection behaviour.

Conclusions

The study intervention, personalized advice, appears to be effective in causing a positive change in the practice of sun protection behaviours, particularly in the practice of sunscreen use among females and of wearing a hat among males. Covert behaviour change was also evident, with subjects demonstrating a greater intention to adopt sun protection measures, observed in the movement between the stages of behaviour change (Transtheoretical Model). Individuals who practiced sun protection behaviours frequently tended to be less fatalistic about their ability to prevent cancer, and less fatalistic about their ability to control cancer if it should occur in their lives. Due to the design of the study, the findings from this study are only applicable to individuals working in corporations that are similar to those utilized in this study.

Implications of the Study

The findings from this study indicate that personalized advice appears to be effective in motivating individuals to increase their practice of sun protection measures. In public campaigns targeting health-related behaviour change, information provided is often general. Future cancer prevention programs in worksites similar to those in this study might want to consider personalizing the health information they provide.

Caveats of the Study

a) The present staging algorithm system allows the potential for misclassifying subjects within the stages of behaviour change. Under this algorithm, the classification assigned to a subject may not provide a comprehensive picture of change in his/her sun protection behaviours. The algorithm defines the term "current use of sun protection" as using sunscreen, wearing a hat, and covering arms and legs with clothing (i.e. protective clothing) when exposed to the sun for extended periods. This definition excludes subjects who have chosen to adopt any one or two of the three sun protection behaviours. This problem did not affect the results of the first research question of the study because separate analyses of each behaviour overcame the problem. The third research question, examining movement between stages of behaviour change, is, however, vulnerable to this misclassification.

b) The study used a one-stage cluster sampling design to randomly assign groups of subjects in departments to one of the three interventions or to the control group. The distribution of subjects in each cluster/department is generally not random, but subjects are often homogeneous with respect to many characteristics. Homogeneity within clusters tends to increase the proportion of total variance attributed to differences between clusters. Increased variance between clusters relative to variance within clusters increases the probability of finding significance in statistical tests which

involve comparisons between clusters (Levy & Lemeshow, 1980; Kish, 1965).

c) The need to provide information on the nature of the study prior to obtaining informed consent from participants could potentially have resulted in participants being furnished with information through cueing or indirect instructions. As a result, the control group may not represent a true control group because controls may have received information indirectly.

Recommendations for Further Research

1) Future studies should examine the reliability and validity of measures of sun protection behaviours across different settings and seasons. Comparisons of self-reported and direct observation may be expensive but effective in verifying self-reported change in behaviour by subjects.

2) Further studies utilizing the present dataset could explore:

a) the relationship between subjects with certain predisposed phenotypical characteristics and their compliance with sun protection recommendations,

b) the role of different age categories and education in influencing the degree of compliance to sun protection recommendations, and

c) whether subjects who demonstrate a change in certain variables, such as knowledge and attitudes, also exhibit a change in sun protection behaviours.

3) To date, little research has been done in addressing the applicability of utilizing the stages of behaviour change staging algorithm for examining behaviours such as sun protection behaviours. Further research is needed to address this question comprehensively.

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APPENDIX A

INFORMATION SHEET

Participation in this research project is entirely voluntary. You may decline to participate or withdraw from the study at any time without prejudice.

Title of Study
Cancer Prevention in the Workplace

This study is being done by the Alberta Cancer Board and Foothills Hospital to compare the effectiveness of different ways of delivering information about cancer prevention. These are: an interactive computer program, and a mailed information letter.

The study will require 1/2 to 1 hour of your time and you will be asked to complete several questionnaires. Each participant will be given an initial **Lifestyle** questionnaire which will request information relating to your background, lifestyle and knowledge about cancer prevention. You will then go on to the **Cancer Me??** portion of the study. This will be in the form of either an interactive computer program or a paper and pencil questionnaire. Based on your answers to the **Cancer Me??** questions, you will receive personalized information on how to reduce your cancer risk. Some participants will receive the information immediately on the computer screen and others will receive the information in a letter mailed to your home soon after completing the questionnaires. Some participants will not receive their personalized information until the end of the study in one years time. All of the volunteers in your work area will receive the same method of information delivery. (The method was determined by chance). All groups will also be asked to complete and return a short **Evaluation** questionnaire once the cancer prevention information has been provided. You will also be asked to fill in a short follow-up questionnaire in six months and again in 12 months time.

Study personnel may need to communicate with you for the purposes of the study. For that reason, we ask for your name, address, telephone number, sex and date of birth on the consent form. We will assign a unique identifier to identify your questionnaires. Your name will **not** appear in any reports or publications resulting from this research. The completed questionnaire will be held by the Alberta Cancer Board and will be kept **strictly confidential** by storing identifying information separately from the information you provide.

The information provided by this study is not a substitute for medical advice. The study is not intended to be, nor should it be relied upon as a means by which to determine if you have cancer. Cancer diagnosis and prevention is a matter for you and your doctor. The Alberta Cancer Board recommends that you consult your doctor if you have any concerns about your health.

If you would like more information on this study, please contact Dr. P. Taenzer (670-1042) or Dr. S. Campbell (670-4862) at the Alberta Cancer Board.

CONSENT FORM

Title of Study
Cancer Prevention in the Workplace

I have been given an Information Sheet on the above project and have read it. The study has been explained to my satisfaction and I agree to participate.

Signature of Participant

Date (year/month/day)

Surname (Please print)

Telephone Number - Work

First Name (Please print)

Telephone Number - Home

Address of Participant

Address:

City:

Postal Code:

Date of Birth

(Year/Month/Day)

STUDY NUMBER

Sex: Male / Female

Participation in this research project is entirely voluntary. You may decline to participate or withdraw from the study at any time without prejudice.

NON-PARTICIPATION FORM

I am not participating in this project because:

- ☐ I'm not interested in cancer prevention.
- ☐ The project didn't seem important.
- ☐ I was too busy.
- ☐ I was out of town.
- ☐ I forgot to complete it.
- ☐ I don't usually participate in research studies.
- ☐ The workplace is not an appropriate setting for a project like this.
- ☐ Other reason (Please specify) _____

I am: ☐ a current smoker ☐ a non smoker

My age is: ☐ 24 or under ☐ 25 - 34 ☐ 35 - 44

☐ 45 - 54 ☐ 55 - 64 ☐ 65 or over

I am: ☐ Male ☐ Female

STUDY NUMBER

APPENDIX B

QUESTIONS UTILIZED IN THE ANALYSIS

The following questions utilized in the current analysis were extracted from the Alberta Cancer Board's project, "Cancer Prevention in the Workplace", study questionnaires. More specific, these questions were taken from the Risk Reduction Behaviour, Lifestyle, and Twelve-Month Questionnaires to represent the variables of interest to the present study.

BACKGROUND INFORMATION QUESTIONS

Risk Reduction Behaviour Questionnaire

1) Variables on ID number, age, sex and the intervention arm of each participant.

2) Do you currently have any serious health problems?
   Category: (Yes, No)

3) Have you ever been told by a doctor that you have any of the following medical conditions?
   a) Dysplastic Nevus Syndrome (an inherited skin condition)
      Category: (Yes, No)

   b) Cancer
      What type of cancer?
      Category: (69 Cancer Types)

4) What colour are your eyes?
   Category: (Blue, Green, Grey, Hazel, Brown, Black)

5) What is your natural hair colour?
   Category: (Blond, Red, Light Brown, Dark Brown, Black)

6) How would you describe your skin colour?
   Category: (Light or Fair, Medium, Dark, Black)

7) Think about the first time you spend time in the sun each year. Which of the following would best describe your skin's reaction to one hour of unprotected exposure to strong sunshine?
   Category: (Always burn, never tan; Usually burn, tan with difficulty; Sometimes mild burn, tan about average; Rarely burn, tan with ease)

Lifestyle Questionnaire

8) Have you been married?
Category: (Yes, No)

Please indicate your present marital status.
Category: (Married, Widowed, Common-Law, Separated, Divorced)

9) What diplomas, certificates or degrees have you obtained? (Include all qualifications obtained from secondary (high) school or trade schools and other postsecondary educational institutions). Mark as many as apply to you.
Category: (None, Secondary/High School certificate or equivalent, Trades Certificate or Diploma, Other Non-University certificate or diploma, University Certificate or Diploma below bachelor level, Bachelor's Degree or higher)

10) How would you rate your general health compared to others your age?
Category: (Excellent, Good, Fair, Poor)

11) When did you last have a general check-up?
Category: (Less than 1 year ago, 1-2 years ago, 3-5 years ago, more than 5 years ago, never)

Twelve-Month Questionnaire

12) Variables on ID number, age, sex and the intervention arm of each participant.

GENERAL CANCER RISK KNOWLEDGE QUESTIONS

Lifestyle and Twelve-Month Questionnaires

13) How important is avoiding sun exposure in reducing the chances of getting cancer?
Category: (Very important, Somewhat important, Not too important, Not at all important)

14) How much do the following affect the chances of getting cancer?
a) Family history
Category: (Great extent, Somewhat, Not much, Not at all)

b) Sun exposure
Category: (Great extent, Somewhat, Not much, Not at all)

15) What are the chances of curing skin cancer if detected early?
Category: (Excellent, Good, Fair, Poor)

BELIEFS REGARDING GETTING CANCER QUESTION

Lifestyle and Twelve-Month Questionnaires

16) How likely do you think it is that you will develop cancer at some point during your lifetime?
Category: (Definitely not get cancer, Unlikely that I will get cancer, chances are 50/50, Likely will get cancer, Definitely get cancer)

ATTITUDES TO CANCER QUESTIONS

Lifestyle and Twelve-Month Questionnaires

17) How much do you agree with each of the following statements?
The same category was used for the following questions.
Category: (Strongly agree, Tend to agree, Uncertain, Tend to disagree, Strongly disagree)

Anxiety
a) I have never worried that I might have cancer.

b) The possibility of getting cancer worries me.

c) Publicity about cancer makes me frightened.

Denial
d) If I had cancer I would not like my friends to know.

e) I do not like to think about cancer.

f) If I had cancer I would rather not know about it.

Fatalism About Prevention
g) There is nothing I can do to prevent cancer.

h) I would not change my habits to avoid getting cancer.

i) If I am going to get cancer then I will get it and there is no point being worried about it now.

Fatalism About Control

j) I think cancer just about always means death.

k) By the time you know you have cancer it has generally gone too far for anything to be done about it.

l) Once cancer invades the body it is impossible to get rid of it.

RISK BEHAVIOUR QUESTIONS

Risk Reduction Behaviour and Twelve-Month Questionnaires

18) When spending time in the sunshine, do you:

a) Cover your arms and legs with clothing?
Category: (Always, Usually, Sometimes, Never)

b) Wear a hat?
Category: (Always, Usually, Sometimes, Never)

c) Use a sunscreen? (SPF of 15 or more)
Category: (Always, Usually, Sometimes, Never)

19) How often do you deliberately avoid going out in strong sunshine between 10 a. m. and 3 p. m.?
Category: (Always, Usually, Sometimes, Never)

STAGES OF CHANGE QUESTIONS

Lifestyle and Twelve-Month Questionnaires

20) Do you currently use sun protection (sunscreen and a hat and long sleeves and pants) when exposed to sunlight for extended periods?
Category: (Yes, No)

21) How long ago did you change (increase) your sun protection practices?
Category: (Weeks ago, Months ago, Years ago)

22) Are you seriously considering using increased sun protection?
Category: (Yes, No)

23) When do you plan on increasing your sun protection practices?
Category: (Immediately, This coming winter, next summer)

APPENDIX C

DISTRIBUTION OF RESPONSE SCORE ON KNOWLEDGE AND ATTITUDES FOR BASELINE AND TWELVE-MONTH

KNOWLEDGE (BASELINE)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	2.00	3	.4	.4	.4
	3.00	27	3.7	3.9	4.3
	4.00	217	29.6	31.1	35.4
	5.00	260	35.5	37.2	72.6
	6.00	132	18.0	18.9	91.5
	7.00	56	7.6	8.0	99.6
	8.00	3	.4	.4	100.0
	.	35	4.8	Missing	
	Total	733	100.0	100.0	

Mean 4.961 Median 5.000 Mode 5.000 Std dev 1.026

Valid cases 698 Missing cases 35

KNOWLEDGE (TWELVE-MONTH)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	2.00	1	.1	.1	.1
	3.00	30	4.1	4.1	4.3
	4.00	202	27.6	27.7	32.0
	5.00	275	37.5	37.8	69.8
	6.00	160	21.8	22.0	91.8
	7.00	46	6.3	6.3	98.1
	8.00	14	1.9	1.9	100.0
	.	5	.7	Missing	
	Total	733	100.0	100.0	

Mean 5.040 Median 5.000 Mode 5.000 Std dev 1.049

Valid cases 728 Missing cases 5

ANXIETY (BASELINE)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	3.00	28	3.8	3.9	3.9
	4.00	43	5.9	5.9	9.8
	5.00	61	8.3	8.4	18.2
	6.00	72	9.8	9.9	28.1
	7.00	87	11.9	12.0	40.0
	8.00	85	11.6	11.7	51.7
	9.00	89	12.1	12.2	64.0
	10.00	119	16.2	16.4	80.3
	11.00	66	9.0	9.1	89.4
	12.00	45	6.1	6.2	95.6
	13.00	19	2.6	2.6	98.2
	14.00	11	1.5	1.5	99.7
	15.00	2	.3	.3	100.0
	.	6	.8	Missing	
	Total	733	100.0	100.0	

Mean 8.212 Median 8.000 Mode 10.000 Std dev 2.658

Valid cases 727 Missing cases 6

DENIAL (BASELINE)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	3.00	20	2.7	2.7	2.7
	4.00	43	5.9	5.9	8.7
	5.00	87	11.9	12.0	20.6
	6.00	134	18.3	18.4	39.0
	7.00	148	20.2	20.3	59.3
	8.00	116	15.8	15.9	75.3
	9.00	91	12.4	12.5	87.8
	10.00	55	7.5	7.6	95.3
	11.00	26	3.5	3.6	98.9
	12.00	7	1.0	1.0	99.9
	13.00	1	.1	.1	100.0
	.	5	.7	Missing	
	Total	733	100.0	100.0	

Mean 7.125 Median 7.000 Mode 7.000 Std dev 1.955

Valid cases 728 Missing cases 5

FATALISM ABOUT PREVENTION (BASELINE)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	3.00	78	10.6	10.7	10.7
	4.00	107	14.6	14.7	25.4
	5.00	127	17.3	17.5	42.9
	6.00	153	20.9	21.0	64.0
	7.00	113	15.4	15.5	79.5
	8.00	62	8.5	8.5	88.0
	9.00	36	4.9	5.0	93.0
	10.00	31	4.2	4.3	97.2
	11.00	14	1.9	1.9	99.2
	12.00	4	.5	.6	99.7
	13.00	1	.1	.1	99.9
	14.00	1	.1	.1	100.0
	.	6	.8	Missing	
	Total	733	100.0	100.0	

Mean 6.004 Median 6.000 Mode 6.000 Std dev 2.048

Valid cases 727 Missing cases 6

FATALISM ABOUT CONTROL (BASELINE)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	3.00	82	11.2	11.3	11.3
	4.00	96	13.1	13.2	24.6
	5.00	79	10.8	10.9	35.4
	6.00	143	19.5	19.7	55.2
	7.00	77	10.5	10.6	65.8
	8.00	81	11.1	11.2	77.0
	9.00	57	7.8	7.9	84.8
	10.00	37	5.0	5.1	89.9
	11.00	29	4.0	4.0	93.9
	12.00	29	4.0	4.0	97.9
	13.00	8	1.1	1.1	99.0
	14.00	5	.7	.7	99.7
	15.00	2	.3	.3	100.0
	.	8	1.1	Missing	
	Total	733	100.0	100.0	

Mean 6.654 Median 6.000 Mode 6.000 Std dev 2.638

Valid cases 725 Missing cases 8

ANXIETY (TWELVE-MONTH)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	3.00	30	4.1	4.1	4.1
	4.00	31	4.2	4.3	8.4
	5.00	58	7.9	8.0	16.4
	6.00	75	10.2	10.3	26.8
	7.00	70	9.5	9.7	36.4
	8.00	98	13.4	13.5	49.9
	9.00	82	11.2	11.3	61.2
	10.00	142	19.4	19.6	80.8
	11.00	57	7.8	7.9	88.7
	12.00	51	7.0	7.0	95.7
	13.00	21	2.9	2.9	98.6
	14.00	6	.8	.8	99.4
	15.00	4	.5	.6	100.0
	.	8	1.1	Missing	
	Total	733	100.0	100.0	

Mean 8.334 Median 9.000 Mode 10.000 Std dev 2.621
Valid cases 725 Missing cases 8

DENIAL (TWELVE-MONTH)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	3.00	14	1.9	1.9	1.9
	4.00	40	5.5	5.5	7.4
	5.00	66	9.0	9.0	16.4
	6.00	120	16.4	16.4	32.9
	7.00	164	22.4	22.5	55.3
	8.00	131	17.9	17.9	73.3
	9.00	107	14.6	14.7	87.9
	10.00	53	7.2	7.3	95.2
	11.00	19	2.6	2.6	97.8
	12.00	9	1.2	1.2	99.0
	13.00	4	.5	.5	99.6
	14.00	2	.3	.3	99.9
	15.00	1	.1	.1	100.0
	.	3	.4	Missing	
	Total	733	100.0	100.0	

Mean 7.333 Median 7.000 Mode 7.000 Std dev 1.945
Valid cases 730 Missing cases 3

FATALISM ABOUT PREVENTION (TWELVE-MONTH)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	3.00	72	9.8	9.9	9.9
	4.00	124	16.9	17.0	26.9
	5.00	127	17.3	17.4	44.3
	6.00	164	22.4	22.5	66.8
	7.00	87	11.9	11.9	78.7
	8.00	79	10.8	10.8	89.6
	9.00	34	4.6	4.7	94.2
	10.00	24	3.3	3.3	97.5
	11.00	12	1.6	1.6	99.2
	12.00	5	.7	.7	99.9
	14.00	1	.1	.1	100.0
	.	4	.5	Missing	
	Total	733	100.0	100.0	

Mean 5.931 Median 6.000 Mode 6.000 Std dev 1.997
Valid cases 729 Missing cases 4

FATALISM ABOUT CONTROL (TWELVE-MONTH)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	3.00	86	11.7	11.9	11.9
	4.00	74	10.1	10.2	22.1
	5.00	89	12.1	12.3	34.3
	6.00	179	24.4	24.7	59.0
	7.00	61	8.3	8.4	67.4
	8.00	69	9.4	9.5	77.0
	9.00	51	7.0	7.0	84.0
	10.00	52	7.1	7.2	91.2
	11.00	23	3.1	3.2	94.3
	12.00	31	4.2	4.3	98.6
	13.00	4	.5	.6	99.2
	14.00	2	.3	.3	99.4
	15.00	4	.5	.6	100.0
	.	8	1.1	Missing	
	Total	733	100.0	100.0	

Mean 6.615 Median 6.000 Mode 6.000 Std dev 2.589
Valid cases 725 Missing cases 8

APPENDIX D

TABLES 6A TO 9D ON MEAN SCORE DISTRIBUTION BETWEEN VARIABLES OF INTEREST AND DEMOGRAPHICS

Table 6A
Mean Score of Behaviours by Gender for Baseline and 12-Month

	GENDER	
Behaviours	Male (n=385) Mean (S.D)	Female (n=348) Mean (S.D)
BASELINE		
Sunscreen	2.88 (0.88)	2.55 (0.96)
Hat	2.75 (0.97)	2.55 (0.97)
Clothing	2.98 (0.80)	2.86 (0.79)
Avoidance	3.23 (0.75)	3.10 (0.89)
TWELVE-MONTH		
Sunscreen	2.73 (0.83)	2.23 (0.95)
Hat	2.64 (0.97)	2.80 (0.93)
Clothing	2.73 (0.76)	2.81 (0.77)
Avoidance	3.12 (0.77)	2.71 (0.78)

Table 6B
Mean Score of Behaviours by Age for Baseline and 12-Month

	AGE			
Behaviours	21-29 (n=120) Mean (S.D)	30-39 (n=335) Mean (S.D)	40-49 (n=206) Mean (S.D)	50-63 (n=72) Mean (S.D)
BASELINE				
Sunscreen	2.83 (0.91)	2.68 (0.93)	2.70 (0.98)	2.79 (0.88)
Hat	3.30 (0.80)	2.76 (0.93)	2.68 (0.95)	2.47 (1.18)
Clothing	3.25 (0.70)	3.07 (0.76)	2.96 (0.82)	2.79 (0.92)
Avoidance	3.07 (0.79)	3.11 (0.83)	3.00 (0.88)	2.87 (0.93)
TWELVE-MONTH				
Sunscreen	2.42 (0.91)	2.45 (0.88)	2.52 (0.99)	2.71 (0.93)
Hat	3.09 (0.85)	2.71 (0.92)	2.62 (0.95)	2.35 (1.10)
Clothing	2.93 (0.71)	2.83 (0.75)	2.68 (0.75)	2.49 (0.90)
Avoidance	2.93 (0.76)	2.89 (0.76)	2.98 (0.85)	2.96 (0.90)

Table 6C
Mean Score of Behaviours by Education for Baseline and 12-Month

	EDUCATION			
Behaviours	None (n=21) Mean (S.D)	Cert/Dipl. (n=150) Mean (S.D)	> 1 < Deg./U Cert/Dipl. (n=165) Mean (S.D)	Deg. & Higher (n=377) Mean (S.D)
BASELINE				
Sunscreen	2.67 (0.97)	2.73 (1.00)	2.74 (0.95)	2.73 (0.89)
Hat	3.10 (1.00)	2.85 (0.97)	2.80 (1.03)	2.77 (0.93)
Clothing	3.19 (0.75)	3.08 (0.80)	3.07 (0.85)	3.00 (0.76)
Avoidance	3.05 (0.87)	3.00 (0.87)	3.00 (0.86)	3.11 (0.81)
TWELVE-MONTH				
Sunscreen	2.48 (0.98)	2.49 (0.96)	2.40 (0.91)	2.54 (0.89)
Hat	3.05 (0.87)	2.83 (0.95)	2.73 (0.98)	2.65 (0.94)
Clothing	2.71 (0.78)	2.74 (0.78)	2.79 (0.77)	2.78 (0.77)
Avoidance	2.86 (0.79)	2.77 (0.77)	2.87 (0.79)	3.02 (0.81)

Note: 1) None = No formal education; Cert/Dipl. = Certificates and/or Diplomas; > 1 < Deg./U Cert/Dipl. = More than 1 year of university but do not have a university degree and/or university certificate or diploma;
Deg. & Higher = University degree and higher qualifications
2) The total number of subjects do not sum up to (n=733) due to missing observations from statistical analyses.

Table 6D
Mean Score of Behaviours by Marital Status for Baseline and 12-Month

	MARITAL STATUS		
Behaviours	Not Married (n=135) Mean (S.D)	Married/C.L. (n=525) Mean (S.D)	Sep/Div/Wid. (n=51) Mean (S.D)
BASELINE			
Sunscreen	2.86 (0.91)	2.70 (0.94)	2.65 (0.87)
Hat	3.16 (0.89)	2.71 (0.97)	2.84 (0.96)
Clothing	3.18 (0.80)	3.00 (0.79)	3.06 (0.79)
Avoidance	3.08 (0.81)	3.07 (0.83)	2.88 (0.97)
TWELVE-MONTH			
Sunscreen	2.53 (0.95)	2.49 (0.91)	2.41 (0.90)
Hat	3.01 (0.86)	2.64 (0.96)	2.76 (0.94)
Clothing	2.84 (0.81)	2.75 (0.77)	2.84 (0.71)
Avoidance	2.95 (0.79)	2.93 (0.82)	2.80 (0.72)

Note: 1) Married/C.L. = Married or Common Law; Sep/Div/Wid = Separated, Divorced or Widowed
2) The total number of subjects do not sum up to (n=733) due to missing observations from statistical analyses.

Table 7A
Mean Score of Knowledge by Gender for Baseline and 12-Month

	GENDER	
	Male (n=385) Mean (S.D)	Female (n=348) Mean (S.D)
Knowledge (Baseline)	5.11 (1.10)	4.80 (0.92)
Knowledge (Twelve-Month)	5.20 (1.09)	4.86 (0.97)

Table 7B
Mean Score of Knowledge by Age for Baseline and 12-Month

	AGE			
	21-29 (n=120) Mean (S.D)	30-39 (n=335) Mean (S.D)	40-49 (n=206) Mean (S.D)	50-63 (n=72) Mean (S.D)
Knowledge (Baseline)	4.97 (1.09)	4.95 (0.98)	4.88 (1.00)	5.25 (1.14)
Knowledge (12-Month)	4.96 (0.99)	5.04 (1.050	5.01 (1.07)	5.28 (1.09)

Table 7C
Mean Score of Knowledge by Education for Baseline and 12-Month

	EDUCATION			
	None (n=21) Mean (S.D)	Cert/Dipl. (n=150) Mean (S.D)	> 1 < Deg./U Cert/Dipl. (n=165) Mean (S.D)	Deg. & Higher (n=377) Mean (S.D)
Knowledge (Baseline)	4.68 (0.86)	4.93 (1.03)	4.98 (1.09)	4.94 (1.00)
Knowledge (12-Month)	5.05 (1.16)	4.97 (1.05)	4.98 (1.09)	5.10 (1.02)

Note: 1) None = No formal education; Cert/Dipl. = Certificates and/or Diplomas; > 1 < Deg./U Cert/Dipl. = More than 1 year of university but do not have a university degree and/or university certificate or diploma;
Deg. & Higher = University degree and higher qualifications
2) The total number of subjects do not sum up to (n=733) due to missing observations from statistical analyses.

Table 7D
Mean Scores of Knowledge by Marital Status for Baseline and 12-Month

	MARITAL STATUS		
	Not Married (n=135) Mean (S.D)	Married/C.L (n=525) Mean (S.D)	Sep/Div/Wid. (n=51) Mean (S.D)
Knowledge (Baseline)	4.99 (1.11)	4.94 (1.01)	5.13 (0.96)
Knowledge (12-Month)	4.96 (1.06)	5.07 (1.05)	5.08 (0.99)

Note: 1) Married/C.L. = Married or Common Law; Sep/Div/Wid = Separated, Divorced or Widowed
2) The total number of subjects do not sum up to (n=733) due to missing observations from statistical analyses.

Table 8A
Mean Score of Attitudes by Gender for Baseline and 12-Month

	GENDER	
Attitudes	Male (n=385) Mean (S.D)	Female (n=348) Mean (S.D)
BASELINE		
Anxiety	7.84 (2.55)	8.63 (2.72)
Denial	7.05 (1.91)	7.20 (2.01)
Fatalism About Prevention	6.03 (2.02)	5.97 (2.07)
Fatalism About Control	6.67 (2.69)	6.63 (2.59)
TWELVE-MONTH		
Anxiety	7.96 (2.58)	8.75 (2.61)
Denial	7.31 (1.88)	7.36 (2.02)
Fatalism About Prevention	5.83 (1.95)	6.05 (2.04)
Fatalism About Control	6.53 (2.61)	6.72 (2.57)

Table 8B
Mean Score of Attitudes by Age for Baseline and 12-Month

	AGE			
Attitudes	21-29 (n=120) Mean (S.D)	30-39 (n=335) Mean (S.D)	40-49 (n=206) Mean (S.D)	50-63 (n=72) Mean (S.D)
BASELINE				
Anxiety	8.11 (2.91)	8.48 (2.61)	8.09 (2.52)	7.47 (2.67)
Denial	6.93 (1.88)	7.18 (1.95)	7.20 (2.01)	6.97 (2.00)
Fatprev	6.06 (1.96)	5.87 (1.97)	5.93 (2.05)	6.77 (2.42)
Fatcont	6.97 (2.48)	6.50 (2.66)	6.78 (2.70)	6.47 (2.63)
TWELVE-MONTH				
Anxiety	8.30 (2.66)	8.51 (2.66)	8.27 (2.55)	7.75 (2.52)
Denial	7.28 (2.01)	7.45 (1.88)	7.27 (1.98)	7.07 (2.03)
Fatprev	6.19 (1.93)	5.75 (1.95)	6.02 (2.08)	6.10 (2.06)
Fatcont	6.66 (2.50)	6.57 (2.56)	6.73 (2.71)	6.45 (2.54)

Table 8C
Mean Score of Attitudes by Education for Baseline and 12-Month

	EDUCATION			
Attitudes	None (n=21) Mean (S.D)	Cert/Dipl. (n=150) Mean (S.D)	> 1 < Deg./U Cert/Dipl. (n=165) Mean (S.D)	Deg. & Higher (n=377) Mean (S.D)
BASELINE				
Anxiety	9.14 (3.09)	8.68 (2.44)	8.26 (2.72)	7.97 (2.67)
Denial	7.38 (1.86)	7.28 (2.02)	7.39 (2.03)	6.94 (1.91)
Fatprev	6.14 (2.63)	6.20 (2.26)	6.09 (2.04)	5.88 (1.93)
Fatcont	6.60 (2.48)	6.96 (2.66)	6.91 (2.73)	6.41 (2.56)
TWELVE-MONTH				
Anxiety	8.91 (2.59)	8.75 (2.57)	8.48 (2.58)	8.06 (2.63)
Denial	7.00 (1.34)	7.38 (1.79)	7.49 (1.97)	7.27 (2.03)
Fatprev	6.62 (2.22)	6.22 (2.12)	5.90 (1.94)	5.79 (1.92)
Fatcont	7.29 (2.92)	7.10 (2.63)	6.72 (2.62)	6.36 (2.31)

Note: 1) None = No formal education; Cert/Dipl. = Certificates and/or Diplomas; > 1 < Deg./U Cert/Dipl. = More than 1 year of university but do not have a university degree and/or university certificate or diploma;
Deg. & Higher = University degree and higher qualifications
2) The total number of subjects do not sum up to (n=733) due to missing observations from statistical analyses.

Table 8D
Mean Score of Attitudes by Marital Status for Baseline and 12-Month

	MARITAL STATUS		
Attitudes	Not Married (n=135) Mean (S.D)	Married/C.L (n=525) Mean (S.D)	Sep/Div/Wid. (n=51) Mean (S.D)
BASELINE			
Anxiety	8.09 (2.84)	8.28 (2.63)	7.94 (2.63)
Denial	7.09 (2.07)	7.16 (1.93)	6.82 (2.11)
Fatprev	6.24 (1.98)	5.94 (2.03)	6.02 (2.28)
Fatcont	6.93 (2.69)	6.65 (2.58)	6.28 (3.05)
TWELVE-MONTH			
Anxiety	8.42 (2.50)	8.33 (2.66)	8.37 (2.50)
Denial	7.50 (2.05)	7.30 (1.92)	7.24 (2.01)
Fatprev	6.19 (2.02)	5.89 (1.97)	5.78 (1.92)
Fatcont	6.64 (2.50)	6.62 (2.60)	7.02 (2.83)

Note: 1) Married/C.L. = Married or Common Law; Sep/Div/Wid = Separated, Divorced or Widowed
2) The total number of subjects do not sum up to (n=733) due to missing observations from statistical analyses.

Table 9A
Mean Score of Beliefs by Gender for Baseline and 12-Month

	GENDER	
	Male (n=385) Mean (S.D)	Female (n=348) Mean (S.D)
Beliefs (Baseline)	2.69 (0.67)	2.84 (0.73)
Beliefs (Twelve-Month)	2.75 (0.75)	2.90 (0.76)

Table 9B
Mean Score of Beliefs by Age for Baseline and 12-Month

	AGE			
	21-29 (n=120) Mean (S.D)	30-39 (n=335) Mean (S.D)	40-49 (n=206) Mean (S.D)	50-63 (n=72) Mean (S.D)
Beliefs (Baseline)	2.69 (0.73)	2.75 (0.70)	2.80 (0.68)	2.83 (0.73)
Beliefs (12-Month)	2.77 (0.90)	2.80 (0.68)	2.87 (0.69)	2.88 (1.03)

Table 9C
Mean Score of Beliefs by Education for Baseline and 12-Month

	EDUCATION			
	None (n=21) Mean (S.D)	Cert/Dipl. (n=150) Mean (S.D)	> 1 < Deg./U Cert/Dipl. (n=165) Mean (S.D)	Deg. & Higher (n=377) Mean (S.D)
Beliefs (Baseline)	2.80 (0.70)	2.85 (0.77)	2.83 (0.69)	2.70 (0.67)
Beliefs (12-Month)	2.86 (0.85)	2.91 (0.70)	2.89 (0.72)	2.75 (0.79)

Note: 1) None = No formal education; Cert/Dipl. = Certificates and/or Diplomas; > 1 < Deg./U Cert/Dipl. = More than 1 year of university but do not have a university degree and/or university certificate or diploma; Deg. & Higher = University degree and higher qualifications
2) The total number of subjects do not sum up to (n=733) due to missing observations from statistical analyses.

Table 9D
Mean Response of Beliefs by Marital Status for Baseline and 12-Month

	MARITAL STATUS		
	Not Married (n=135) Mean (S.D)	Married/C.L (n=525) Mean (S.D)	Sep/Div/Wid. (n=51) Mean (S.D)
Beliefs (Baseline)	2.74 (0.75)	2.77 (0.67)	2.75 (0.82)
Beliefs (12-Month)	2.78 (0.90)	2.82 (0.72)	2.92 (0.77)

Note: 1) Married/C.L. = Married or Common Law; Sep/Div/Wid = Separated, Divorced or Widowed
2) The total number of subjects do not sum up to (n=733) due to missing observations from statistical analyses.